SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1890, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXII.—No. 10. ESTABLISHED 1845. | NEW YORK, MARCH 8, 1890. | $3.00 A YEAR. WEEKLY.

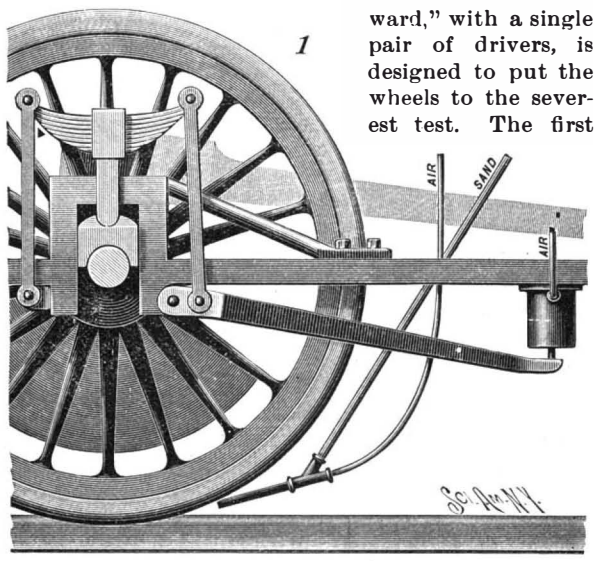
NEW TYPE OF LOCOMOTIVE DRIVING WHEELS.

We illustrate in the present issue a locomotive that has recently been placed upon the tracks of the Central R.R. of New Jersey. The engine was built to demonstrate the efficiency of the Swinerton driving wheel. The wheel offers a radical departure from theories hitherto followed. The Swinerton wheel is polygonal. It is claimed that by substituting for the cylindrical surface of the driving wheel a many-sided prism, greater traction is obtained.

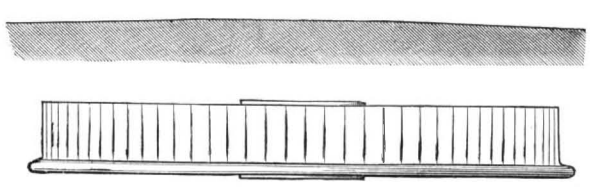
The engine was built by the Hinkley Locomotive Company for the Swinerton Locomotive Driving Wheel Company, under instructions to spare neither labor, skill, nor expense, but to make the best engine possible. On the first of December, 1887, the engine was finished. It was built for high speed passenger service. Its general data are as follows: Weight of engine, 45 tons; weight on drivers, 32,000 lb.; drivers, 5 ft. 6 in.; trailing wheels (self-adjusting for curves), 42 in.; treading truck wheels, 36 in. All wheels except the drivers are of wrought iron. Cylinders (with Richardson slide valve) 18 in. by 24 in. The boiler is of steel with 90 in. by 42 in. grate and 220 1¾ in. tubes. It carries 150 lb. of steam. The engine is fitted with Westinghouse automatic and with vacuum brakes, and has steam-heating apparatus for warming the train. It has a water scoop for taking water from a track trough.

The principal feature of interest which the engine was built to illustrate is its driving wheel tires. These are covered by patents of C. E. Swinerton, president of the company. In outline each of these represents a polygon with sides one inch long, giving about 210 sides for the entire circumference. Looking at the wheel under favorable circumstances, the sides are barely noticeable. If the light shines at the right angle upon the periphery, they can be clearly distinguished. A short straight edge, even a pencil sufficing, discloses the existence of facets by the rocking or oscillation as it passes from face to face. The exact angle of the facets is shown in Fig. 2.

The object of the polygonal wheel is to increase traction, and very remarkable results are claimed for it in this regard. Several ordinary engines have been fitted with the tire and have run for long periods in regular service. The "Onward," with a single pair of drivers, is designed to put the wheels to the severest test. The first



DEVICE FOR INCREASING WEIGHT ON DRIVERS.



PERIPHERY OF WHEEL, SHOWING FACETS.

regular work of the "Onward" was in regular service on the Boston and Maine Railroad, where for six months it pulled the Portland express, a distance of 115 miles, with six to eight cars. Previous to this commission the tractive power had been tried, and for several days it hauled 65 to 70 cars of coal from Boston to Lowell. This went to prove its capacity for handling loads usually pulled by four-driver engines.

After the B. & M. runs were concluded in July, 1889, some special tests were made. A gradient of 37 feet to the mile was selected, and the number of cars which the engine could pull with and without sand was determined. Then the tires were turned off round and the same trials were repeated. The results as reported were remarkable, showing a great increase in tractive power from the use of polygonal tires.

The following table gives an abstract of these trials:

TRIALS OF ENGINE "ONWARD," FITTED WITH POLYGONAL WHEELS, JULY, 16, 1889.

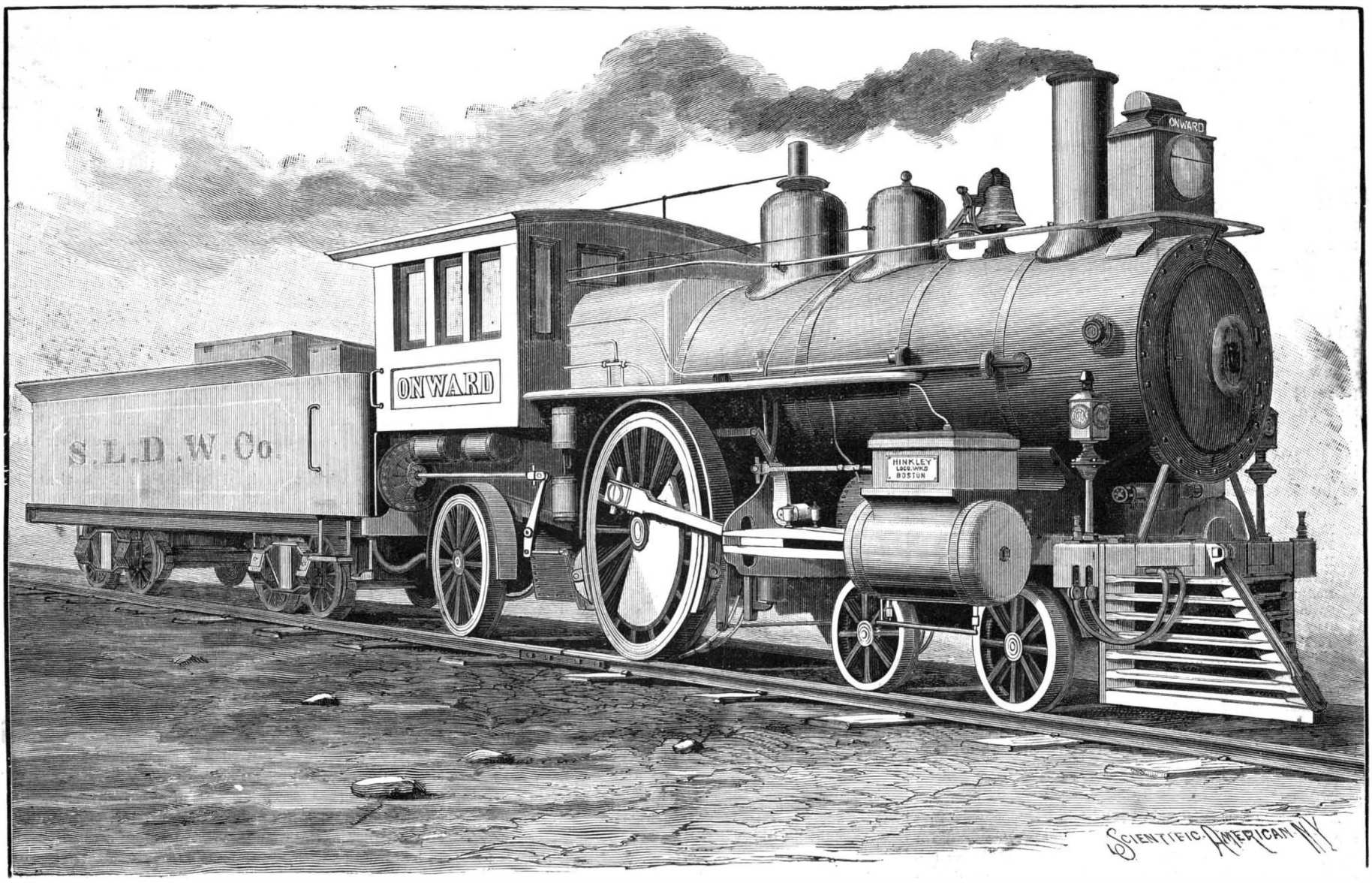
Method of working.	Gondola cars.	Short coal cars	Engineer.	Weight of cars and load.	Total weight, including engine and tender.
				Lbs.	Lbs.
Without sand..	10	10	F. F. Coggin.	859,550	1,002,700
With sand.....	10	35	L. C. Todd.	1,328,346	1,471,496

TRIAL OF ENGINE "ONWARD," FITTED WITH ROUND WHEELS, JULY 23, 1889.

Method of working.	Gondola cars.	Short coal cars.	Engineer.	Weight of cars and load.	Total weight, including engine and tender.
				Lbs.	Lbs.
Without sand..	5	—	F. S. Saunders	320,500	463,650
With sand.....	11	11	F. F. Coggin..	830,870	974,020

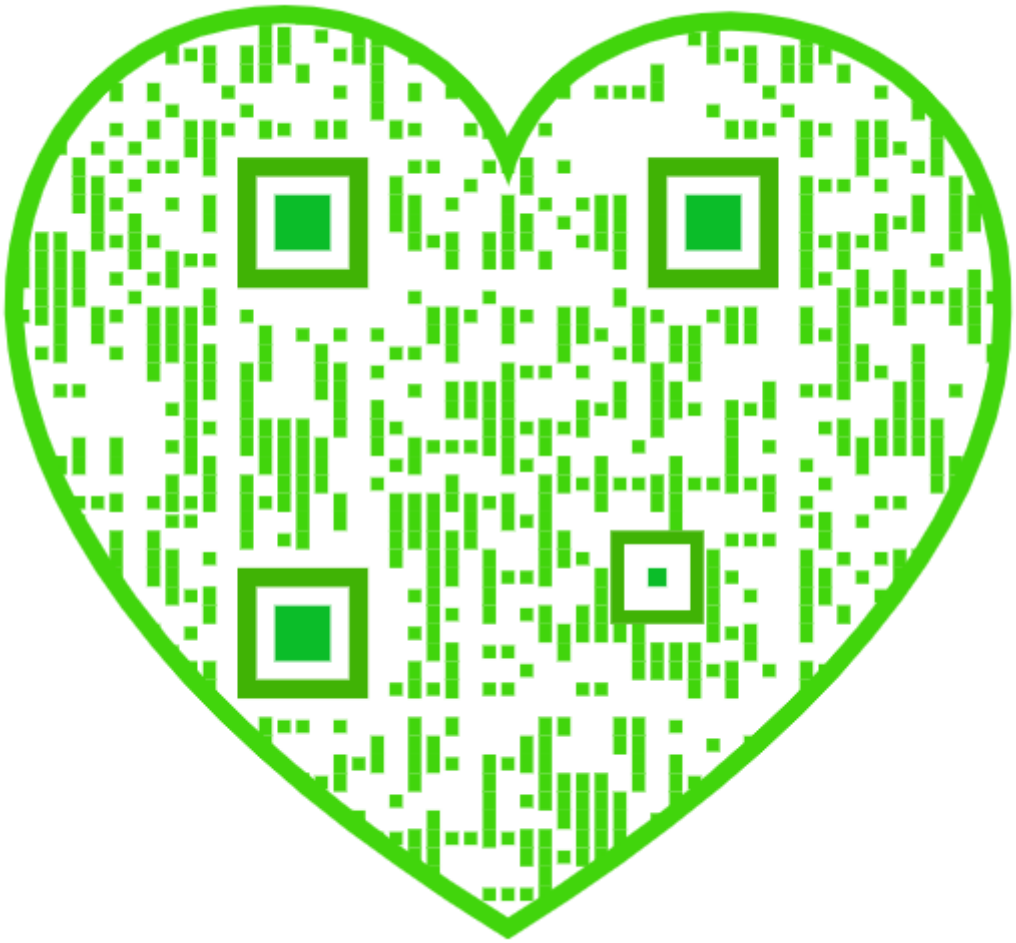
The change of engineers was made to avoid any charge of partiality. One very peculiar result is the comparatively little difference in tractile power due to the use of sand in the case of the polygonal wheels. The disproportion in the loads moved by the polygonal and circular wheels is very striking in both cases.

As regards practical points, it is found that the engine runs as quietly as any other. The departure from



HIGH SPEED LOCOMOTIVE WITH SINGLE PAIR OF POLYGONAL DRIVING WHEELS.

© 1890 SCIENTIFIC AMERICAN, INC.



the circle is too slight to occasion any rattling. In the first experiments, wheels with 2 inch facets were tried, and even they could not be distinguished in quietness of running from round wheels. In wearing, the facets do not disappear. It is found that a flat spot upon a tire in ordinary work never wears away. In like manner, the many flat spots on the Swinerton tire are preserved. An engine which ran 60,000 miles upon the Boston and Lowell R.R. with polygonal tires wore down 3/8 in. from their periphery, but the characteristic surface was preserved to the last. Since the engine has been on the Jersey Central R. R. she has been pulling a train of five cars from Jersey City to Easton, Pa., a distance of 75 miles, with 14 stops, in two hours and two minutes.

There are no equalizing levers between the trailing wheels and drivers in the "Onward," and a special pneumatic cylinder and lever is used for increasing, if necessary, the pressure upon the drivers. Its construction is shown in the small cut, Fig. 1. By admitting air to the cylinder, about 4,000 pounds additional weight can be placed, and a vertical play of about 7/8 inch is possible.

Another special device is the sanding blast. Compressed air from the reservoir is used to drive the sand under the wheels. This is shown in the same cut. Compressed air is also used to ring the bell, a little cylinder arranged at its side operating the crank.

The facets are produced by a milling machine. The wheel or tire under treatment is milled across once for each face, and the operation is quite simple and cheap. The future of the polygonal tire will be watched with much interest by the railroad world.

New System of Butter Shows in Denmark.

The new plan has the support of a large number of dairies, dairy experts, and leading butter merchants all over the country. It principal features are:

1. A continuous butter show at the expense of the State during several months in each year.

2. Here fresh samples of butter will be received every 14 days, the judges' decision to be given on the butter as received and its condition at the end of 14 days. Thus there will be two distinct testings, not only of quality, but also of weight.

3. The samples are to be sent immediately on the receipt of a letter or telegram, so that the dairymen will not be able to make a special cask for exhibition, and the samples are to be repeated as often as required.

4. Competing dairies must send in a return of the feeding and system generally followed on the farm, with especial reference to the week during which the samples are sent in. At present the number of dairies entered is 360. Nine judges have been selected, and these act in groups of three each, each group recording an independent opinion on each sample, which is checked by those of the other two groups. Each group will consist of two butter merchants and one dairy expert. The exhibitors are paid the usual market rate for their exhibits. The shows will be held at intervals of a fortnight during eight months of the year, and the government grant during the current financial year is £1,350. As the same dairy will send in butter several times in the course of the year, great facilities will be afforded for ascertaining which are the best managed dairies, and it will then be seen where the art of butter making may best be learned. The report concludes by reproducing a series of questions in regard to dairy management put to the managers of competing dairies.

Principal Navies of the World.

The effective force of the United States navy, when all the ships now authorized are completed, excluding those which by the process of decay and the operation of law will by that date have been condemned, will comprise 11 armored vessels, of which only 3 are battle ships, and 31 unarmored vessels, making a total of 42. The following statement shows the number of war vessels on the effective list of the principal foreign powers, built, building, or projected, at the present time, and exclusive of sailing and practice ships:

Country.	Armored.	Unarmored.	Total.
England	76	291	367
France	57	203	260
Russia	49	119	168
Germany	40	65	105
Holland	24	70	94
Spain	12	78	90
Italy	19	67	86
Turkey	15	66	81
China	7	66	73
Sweden and Norway	20	44	64
Austria	12	44	56
United States	11	31	42

The table shows that even when the present building programme is completed the United States cannot take rank as a naval power.

AVENINE, the existence of which in oats was first announced by A. Sanson, has been vainly looked for by Wrampelmeyer ("Landw. Versuch."), who was unable, even by Sanson's published method, to detect such an alkaloid in the oat.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico..... $3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

NEW YORK, SATURDAY, MARCH 8, 1890.

Contents.

(Illustrated articles are marked with an asterisk.)

Age, old, privilege..... 154
Apparatus, game, Pries'*..... 150
Appliances, railway..... 156
Banker, centenarian..... 147
Battery, storage, simple..... 148
Bedstead, siding, Blanken's*..... 149
Bison, American..... 150
Boil, to abort..... 149
Books and publications, new..... 156
Bridge, Kentucky River*..... 153
Business and personal..... 156
Business, cruel..... 150
Camera, hand, magazine*..... 148
Cases, patent, expert court for..... 155
Clamp, rope, Young's*..... 149
Colors, glass..... 147
Cultivator, Henry's*..... 149
Cutter, tool, Smith's*..... 149
Developer, eikonogen..... 146
Drivers, increasing traction*. 145
Fair, world's, 1892..... 146
Farmer a skilled laborer..... 149
Freaks, natural gas..... 154
Gates on passenger cars..... 153
Glass, aluminous..... 153
Grippe and doctors..... 147
Hoe, horse, Emery's*..... 149
Inventions, agricultural..... 156
Inventions, engineering..... 156
Inventions, index of..... 157
Inventions, mechanical..... 156
Inventions, miscellaneous..... 156
Japanese, why they stoop..... 150
Labels, plant, zinc, marking..... 151
Lacquer, Japanese..... 148
Lamp, Grube's*..... 150
Leprosy..... 147
Lighting, magnesium..... 154
Line, border, Uncle Sam's..... 151
Locomotive, high speed*..... 145
Loop and great trestle, Hagerman's, Col.*..... 154
Loop, Georgetown, Col.*..... 152
Measure, tape, Grierson's*..... 150
Mechanics, good material for..... 148
Meteor, a large..... 151
Navies of the world..... 146
Notes and queries..... 156
Phonograph, scientific use of*..... 155
Planets for March..... 147
Plant, sisal, at Nassau, N. P.*..... 148
Prices, agricultural..... 151
Railway practice in America*..... 152
Shows, butter, in Denmark..... 146
Silk, artificial, invention..... 150
South, prosperous..... 153
Teeth, care of, in childhood..... 150
Test, white lead..... 153
Tetanus, treatment of..... 153
Viaduct, curved, Georgetown, Col.*..... 152
Viaduct, portage, new*..... 152
View from Rocky Point, Col.*..... 153
Weather, prediction..... 151
Wells, gas, wonders of..... 155
Wheels, driving locomotive, new type*..... 145
Winters, warm, and Gulf Stream. 151

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 740.

For the Week Ending March 8, 1890.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARBORICULTURE.—The Growth of Trees.—How trees grow, with suggestions as to best means of planting them..... 11816
II. ASTRONOMY.—Star Distances.—An interesting paper on the work recently done in astronomy to determine star parallaxes.... 11816
III. BIOGRAPHY.—Henry M. Stanley.—Two portraits of the great explorer, with notes of his reception at Cairo.—3 illustrations..... 11816
IV. CHEMISTRY.—Detecting Tin in Minerals.—A blowpipe test for determining tin, a simple method applicable in the field..... 11830
Native Wyoming Soap.—By HERMAN WESTPHAL.—A curious mineral found in Wyoming Territory, its general properties and a full analysis of its constituents..... 11830
V. CIVIL ENGINEERING.—Testing the Forth Bridge.—Description of the opening of the Forth Bridge, with illustration of the completed structure.—1 illustration..... 11819
The New Reservoirs at Montmartre.—New reservoirs recently completed for the supply of Paris, involving a three-story structure for the retention of water.—8 illustrations..... 11819
VI. CYCLING.—A Water Walker.—A species of water quadricycle recently tried in England.—1 illustration..... 11819
The Stanley Cycle Show.—Notes of the Stanley cycle exhibit and of the novelties in bicycles, etc., there displayed..... 11818
VII.—ELECTRICITY.—Magnetism.—By Dr. JOHN HOPKINSON.—The conclusion of this authoritative and exhaustive lecture, with discussion which followed its reading.—11 illustrations..... 11826
VIII. GEOGRAPHY AND EXPLORATIONS.—Mr. Stanley's Latest African Discoveries.—A note of the recent discoveries of Mr. Stanley and of the Mountains of the Moon, giving a clew to the ultimate sources of the head waters of the Nile..... 11815
IX. IRRIGATION.—Surface Waters.—Continuation of this exhaustive report on the law regulating rights in surface waters..... 11817
X. MATHEMATICS.—Design for a Conicograph.—By ROLLIN A. HARRIS.—A species of trammel for drawing ellipses and hyperbolas.—Its use fully described and illustrated.—4 illustrations..... 11823
XI. MECHANICAL ENGINEERING.—An Index Plate for Amateurs.—By Lieut. C. D. PARKHURST.—The simple method of producing on a lathe an accurately divided face plate, fully illustrated.—9 illustrations..... 11824
XII. MEDICINE AND HYGIENE.—Aneurism of Scalp.—An operation described by which this troublesome affection was treated.—With notes of its success.—2 illustrations..... 11828
Olive Oil for Snake Bites.—A proposed simple remedy for curing snake bites, with notes of its application to other complaints..... 11828
Treatment of Barber's Itch.—Formula for an ointment for the treatment of this complaint..... 11828
XIII. METALLURGY.—Magnesium Bronze.—By H. N. WARREN.—A curious alloy, exhibiting very remarkable properties, with account of its appearance and other data..... 11825
The Macarthur-Forrest Process for the Treatment of Refractory Gold Ores.—By WILLIAM JONES.—A novel and interesting process utilizing the affinity of cyanogen for gold and silver, offering apparently a very important solution of the problem..... 11825
XIV. METROLOGY.—Labors of the International Bureau of Weights and Measures.—Exceedingly interesting details of the work of this commission with illustrations of an elaborate apparatus used for comparing and of the standard weights and measures.—6 illustrations..... 11821
XV. MISCELLANEOUS.—A Jungle Cart.—A primitive conveyance used in India.—1 illustration..... 11828
The Japanese Puzzle.—An interesting and beautiful recreation, being a development of the well known Chinese puzzle.—2 illustrations..... 11829
XVI. NATURAL HISTORY.—Drum Fish of Mauritius.—A curious fish, producing a drumming noise, with a possible explanation of the organs used in producing the sound..... 11830
XVII. NAVAL ENGINEERING.—The Screw Tug Kathleen.—The largest and most powerful tug yet built in the west of England.—With triple expansion engines and screw propulsion.—3 illustrations..... 11818

THE WORLD'S FAIR OF 1892—CHICAGO FAVORED BY THE HOUSE OF REPRESENTATIVES.

The contest in the House of Representatives relative to the selection of a place for a world's fair in 1892 was brought to a close on the 24th ult. after eight ballots, and resulted in favor of Chicago. The vote was: For Chicago, 157; New York, 107; St. Louis, 25; Washington, 18. Necessary to a choice, 154.

The citizens of New York were chagrined at this result. They had proceeded upon the theory that a successful fair, worthy of the dignity and greatness of the country, implied the necessity of a solid financial basis, an attractive site, and the best conveniences for the largest numbers of visitors. Five millions of dollars were raised by private subscription, ten millions more were provided for by State law, and a magnificent location was chosen in the heart of the metropolis. Thus prepared, the New Yorkers presented themselves before Congress; but a majority of votes were captured by the Chicagoans. Whether the Senate will confirm the choice of the House is yet to be seen. It still remains for Chicago to provide a site, to raise the required fifteen millions, and induce the necessary multitudes to come to her display. These are not generally considered easy matters of accomplishment; but if we may judge by the facility with which the Chicago people carried the House and their present glowing enthusiasm, they will encounter no real difficulties. The fair will apparently drop down upon Chicago almost self-made, under the magic touch of her enterprising people.

Let us hope this may prove true, and that Chicago will show to the world she really deserves the proud distinction she claims, that of being the most liberal, practical, and active city in the world.

In the discussion which took place in Congress, several very forcible and interesting speeches were made. One of the strongest, and which, perhaps, had more influence than any other, was that of the Hon. Wm. M. Springer, of Illinois. It was chiefly devoted to belittling the Empire State and city. His diatribe was ingenious, imposing, and successful, for it carried the votes.

One of the best speeches upon the merits of Chicago was that by the Hon. Abner Taylor, of Illinois. He said:

"A great empire has grown up west of the Allegheny Mountains in the last century that the people of New York seem to know but little about; and I desire that this fair shall be held in the West for the purpose of educating the people of New York to a knowledge of this great empire. [Laughter and applause.] For the last half century this great empire has furnished the cow and the grass and the corn, and New York has done the milking. This empire now desires to do some of the milking herself; and by the noise from New York I should judge that they realize there that the weaning time has come. [Laughter.]

"But, Mr. Speaker, when I rose I did not intend to say anything derogatory to any of these great cities. They are all worthy of a fair, and my great regret is that we cannot locate one in each of them. All fair-minded men will admit that New York has many things to commend her as a place for this exhibition, and as for this beautiful city of Washington, I do not find it in my heart to say aught against her. She is a magnificent city. St. Louis is our neighbor, and if the fair is to be located there, her people will do all that can be done to make it a success.

"But after you have counted the advantages of all these cities, I invite you to go with me to the phenomenal city washed by the waters of Lake Michigan. I say phenomenal, because there has never been in the history of the world another city of twice her age with over a million inhabitants. She is younger than many of the members of this House. Go with me and look at that city carefully, at her great hotels, her great railroads, her sites for this fair in every quarter of the city, and I am satisfied that you will agree with me that she embraces all the advantages of the other three cities together.

"I agree with my friend from New York that this fair should be held amidst a dense population and in a great agricultural country. Let us see how Chicago is situated in that respect. She has a million inhabitants. She is surrounded by large cities, towns, and villages. She is located in one of the richest agricultural countries in the world, which is dotted all over with farms in a high state of cultivation, and inhabited by prosperous and intelligent farmers who have time and money and will to join and make this fair a grand one.

"The country tributary to her and lying within twelve hours' ride of the city—Illinois, Wisconsin, Iowa, Missouri, Kentucky, Ohio, Indiana, Michigan, and Minnesota—grows over half of the wheat of this country and more than 60 per cent of the oats and corn. [Applause.] So you can see very readily that the country that produces this much is in a splendid condition to help to make this great show a grand success. Chicago handles more grain than any other city in the world; Chicago has a larger meat trade than any other two cities in the world; Chicago has more railroad terminals, greater general facilities for all

© 1890 SCIENTIFIC AMERICAN, INC.

classes of railroad business, and more miles of side track than any other city in the world; she has more acres of public parks connected by more miles of boulevards than any other city in the world; she has a larger inland shipping trade than any other city in the world and larger than any other three cities in the United States. [Applause.]

"Chicago is inhabited by a people whose hearts and hands are always open to any great enterprise that serves to develop and build up this country and for the benefit of mankind. Her people have obliterated from their vocabulary the word "fail." They do not understand its meaning. The world-wide reputation of her citizens for ability, energy, and push will assure every one that if the fair is located there, it will be a brilliant success and a celebration in every way fitting as the world's tribute to the noble mariner who discovered our hemisphere."

LEPROSY.

A number of events have recently occurred which indicate that scientists and philanthropists at the centers of civilization are waking up to the necessity of steps being taken for the acquirement of fuller and more correct knowledge of the disease of leprosy, to the end that its victims may be relieved and the further spread of the disease be checked.

On January 13 last a dinner was given in London as a means for promoting the interests of the National Leprosy Fund, which has recently been started in response to a very strong feeling that something should be done to check the spread of leprosy in the British possessions, not only from motives purely humane, but also because the continued increase of the disease is in danger of becoming a national peril.

The Archbishop of Canterbury said in his speech at this dinner that in the old churches in England could still be seen the lepers' side window in the chancel, where in former times the lepers stood to hear the services and to receive alms without coming in contact with those unaffected by the plague. Now, however, the disease is seldom met with in England, but it is more widely diffused through the earth than most people imagine. It prevails, in fact, over more than one-half the habitable globe. It is known from the tropics to the Arctic regions, embracing almost every variety of soil and climate and the various races of men. Maritime populations are the most generally affected, but the disease is by no means confined to them. It prevails in marshy as well as mountainous regions, in the lowlands of Louisiana as well as in the elevated table lands of Mexico. It would be extremely difficult to make a reliable estimate of the number of lepers in the world. The Prince of Wales, who has of late given a great deal of time and thought to the subject of leprosy, and who presided at the recent leprosy fund dinner, said that the wide prevalence of the disease in the Indian empire is an undoubted fact, but that the true extent of it is not really known. The census of 1881 he said gave 131,618 as the number of lepers in all India, 53,886 being credited to the Bengal presidency alone. It is thought that there are now 200,000 lepers in India, while in China, Japan, Africa, and Egypt, which is supposed to have been the starting place of the disease, there are many victims. In Norway and Sweden there are many cases, though the methods adopted by the government for treating persons afflicted with the disease have resulted in checking its progress. It is said that the development of leprosy throughout a great portion of Europe early in our present era may be traced along the routes of the Roman armies, and its general diffusion throughout Christendom in the eleventh, twelfth, and thirteenth centuries was materially influenced by the return of the Crusaders. Leprosy was first introduced into Central and South America by Portuguese traders, in Mexico probably by the Spanish, and into Canada by the French *imigres*. As regards the United States, it is said to have been carried to Louisiana by the Acadians, and it still exists there. In the winter of 1888 there were 42 cases reported in New Orleans, and there are two leper settlements in the State, one at La Fourche and the other at St. Martinsville. The disease was planted in Iowa, Illinois, Wisconsin, and Minnesota by the Scandinavian colonists, and this section was visited in 1888 by the distinguished Norwegian physician, G. Armaner Hansen, who for many years was associated with Dr. Danielson in the government hospitals for lepers in Bergen, Norway. He gave considerable attention to the disease as it came under his observation. In Minnesota, Wisconsin, and Dakota, Dr. Hansen found that 160 lepers had come there from Norway, of whom thirteen were living, and of all their descendants not one had the taint of leprosy. Along the Pacific in California and Oregon the disease was planted by the Chinese, and on the Southern Atlantic coast it was brought from the West Indies. In Salt Lake City the plague was imported by a colony of Kanaka women brought by the Mormons from the Sandwich Islands. There is a lazaretto for lepers at the village of Tracadie, province of New Brunswick, in which general locality the disease has existed many years. Recently the Canadian government has decided to retain the services of Dr. A. C. Smith, an expert in leprosy, who, since the discovery last year of three cases on Cape Breton Island, has been making a thorough investigation into the ramifications of the disease.

The lepers forming the settlement at Molokai, in the Sandwich Islands, number upward of eleven hundred, and here it is said all phases of the disease can best be observed. The locality has recently become famous as the scene of Father Damien's self-sacrificing labors and heroic death. Public attention has again been directed to this singular community by the arrival in this country on January 30 of Miss Amy C. Fowler, the daughter of a clergyman of the Church of England, who has embraced the Catholic faith, and is now known as Sister Rose Gertrude. She is *en route* for Molokai, where she will devote her life to the lepers, taking up and carrying on the work of Father Damien.

It will be seen from the facts here presented that while the disease of leprosy is scattered over a wide extent of territory, it numbers many victims. It is known to be increasing in Cape Colony, and it is said to be spreading in South Africa and the West Indies; but notwithstanding the fact that the disease is of very ancient origin, and has come under the eye of physicians for ages, comparatively little is actually known about it or the best methods of treatment. On this point Dr. Prince Morrow said, in an address before the New York Academy of Medicine, in June last, that "it is the reproach of medical science that a disease which has been characterized as the most ancient and the most exclusively human of all diseases should, after centuries of observation, be so imperfectly understood." This points unmistakably to the fact that a wide field is open to the scientists as well as the philanthropists of the world for the investigation and relief or cure of leprosy.

The National Leprosy Fund, of which upward of £7,000 has been subscribed, will be used in part for the endowment of two scholarships, the holder of one of which will make it his business to study the disease in the United Kingdom and Europe, while the holder of the other is to go abroad and study leprosy in India, China, and the British colonies. As a proof that there is a good prospect of achieving substantial results from efforts in the direction indicated, it is only necessary to quote the opinion recently expressed by so eminent an authority as Mr. Jonathan Hutchinson, president of the Royal College of Surgeons, London, who said that only earnest and steadfast devotion and attention to the disease is needed in order to discover the causes of leprosy and the means of putting an end to it. The discovery of the remedy might not immediately follow that of the cause, but it would follow with sure and certain steps, and he believed that it would not be very far distant. He said that he would be far from doing anything which would reflect on the diligence and zeal of his profession, but he would say that its members were all the better for a good vigorous push from behind occasionally, and if the public should take this question up and feel an interest in it, an increased interest would be taken in it by the medical profession.

As a further outcome of the awakened interest in regard to the disease of leprosy, a meeting occurred in Brooklyn, N. Y., February 13, when papers were read on the subject, and a meeting took place of the recently formed American Leprosy Society. Miss Amy Fowler was present, and it was announced that she would sail from San Francisco for the leper settlement at Molokai on February 28.

POSITION OF THE PLANETS FOR MARCH.

SATURN

is evening star, and holds the first place among the planetary brotherhood during the month, on account of his brilliancy and the ease with which he may be observed. The chief feature of interest is his change of position in regard to Regulus. He approaches the bright star until the 28th, when planet and star are in conjunction, or in the same right ascension. Saturn then passes west of Regulus and recedes from it, his position at conjunction being about a degree and a half north of the star.

Saturn sets on the 1st at 6 h. 13 m. A. M. On the 31st, he sets at 4 h. 9 m. A. M. His diameter on the 1st is 18".8, and he is in the constellation Leo.

MARS

is morning star, and like Saturn moves in the vicinity of a large star, although the conditions are different. Mars is in conjunction with Beta Scorpii on the 4th at 11 h. P. M., being at that time only 8' north of the star. Planet and star are below the horizon when the conjunction occurs, but Mars rises on the morning of the 5th soon after midnight, and will then be east of Beta Scorpii and near it. The ruddy color of the planet and the yellow tint of the star are finely contrasted.

Mars rises on the 1st at 0 h. 19 m. A. M. On the 31st, he rises at 11 h. 12 m. P. M. His diameter on the 1st is 9".4, and he is in the constellation Scorpio.

JUPITER

is morning star. Observers who command a view of the southeastern sky will find the regal planet beautiful to behold in his role of morning star. He rises about an hour and a half before the sun on the first of the month, and about two hours and a half before the sun at its close.

Jupiter rises on the 1st at 4 h. 46 m. A. M. On the 31st, he rises at 3 h. 5 m. A. M. His diameter on the 1st is 32".0, and he is in the constellation Capricornus.

VENUS

is evening star, and is still too close to the sun to be easily seen. The season of her visibility is approaching, and sharpsighted observers may obtain a glimpse of her at the close of the month, when she sets nearly an hour after the sun. She must be looked for 3° north of the sunset point.

Venus sets on the 1st at 5 h. 54 m. P. M. On the 31st, she sets at 7 h. 6 m. P. M. Her diameter on the 1st is 10".0, and she is in the constellation Aquarius.

MERCURY

is morning star. He is traveling from western elongation to superior conjunction and is too near the sun to be visible.

Mercury rises on the 1st at 5 h. 31 m. A. M. On the 31st, he rises at 5 h. 34 m. A. M. His diameter on the 1st is 6".4, and he is in the constellation Capricornus.

URANUS

is morning star and is in good position for observation with the unaided eye. He may be found about 5° northeast of Spica.

Uranus rises on the 1st at 9 h. 28 m. P. M. On the 31st, he rises at 7 h. 25 m. P. M. His diameter on the 1st is 3".8, and he is in the constellation Virgo.

NEPTUNE

is evening star. He sets on the 1st at 0 h. 30 m. A. M. On the 31st, he sets at 10 h. 35 m. P. M. His diameter on the 1st is 2".6, and he is in the constellation Taurus.

Mercury, Jupiter, Mars, and Uranus are morning stars at the close of the month; Venus, Saturn, and Neptune are evening stars.

Glass Colors.

In the *Diamant*, of Leipzig, an account is given of R. Zsigmondy's experiments in coloring glass with metallic sulphides, such as molybdenite, and sulphurets of antimony, copper, bismuth, and nickel. Tests made with batches of 10–20 kg., and with a heat not too great, gave good results, as follows:

Sand 65 dekagrammes, potash 15, soda 5, lime 9, molybdenite 3, sulphide of sodium 2, gave a dark reddish-brown ruby glass. In thinner layers this glass appeared light brownish-yellow. Flashed with opal, it became a smutty black-brown.

Sand 50 dg., potash 15, soda 5, lime 9, molybdenite 1, sulphuret of sodium 2, gave a yellow glass.

Sand 10 parts, potash 3·3, soda 0·27, lime 1·64, molybdenite 0·03, gave a reddish-yellow glass with a fine tinge of red.

Sand 100 parts, potash 26, soda 1·8, lime 12, sulphuret of copper 1·7, sulphide of sodium 2·3, gave a dark-brown color, varying from sepia to sienna. In thick layers it was no longer transparent, but still clear and unclouded. When heated, this glass became smutty black-brown and clouded.

A fine copper-red ruby was obtained from a batch of 10 lb. sand, potash 3 lb., lime 1·2 lb., soda 0·25 lb, sulphuret of copper 7·5 kg., sulphide of sodium 10·5 kg., borax 9·5 kg.

The attempts to color with sulphurets of antimony and bismuth failed. The sulphurets were volatilized, and the resulting glass was almost colorless. But the addition of 5 per cent of sulphuret of nickel to an ordinary batch gave a glass of fine amethyst violet color.

The Grippe and the Doctors.

Give us a rest, says the *Medical Record*. Now that the epidemic of influenza is over, we trust that the poor tired doctors will have a rest. It is really too bad to learn that "our doctor made one hundred and forty visits yesterday," also, "our doctor is very busy, and has not slept for fourteen nights." Too busy by far. How do our patients find out all this? But seriously, if the grip had lasted much longer, it might have killed off all our best men. We hope this good man who owes himself fourteen nights' sleep will soon catch up, that the poor man who "has not had his clothes off for a week" has had a bath, and that the one hundred and forty daily patients of the other unfortunate overworked man are still alive to appreciate his herculean labors. Take care, doctor! Either a pillar of salt or an obituary is in waiting.

A Centenarian Banker.

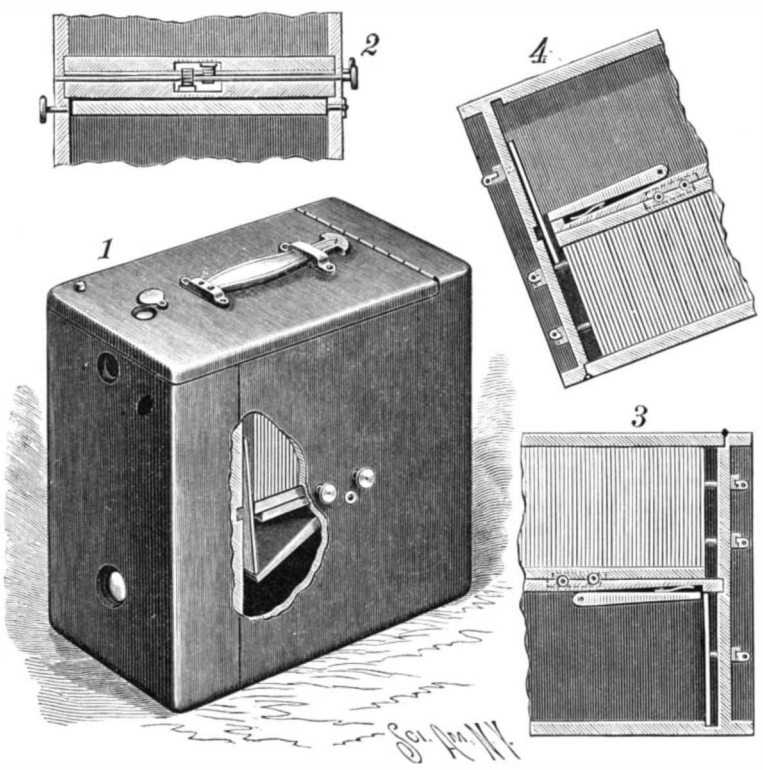
In Lansingburg, N. Y., resides Mrs. Deborah Powers in her hundredth year, as smart as a cricket. Since the death of her husband she has been the managing head of the Powers Bank, one of the oldest private banking institutions in this section. She also attends to household affairs. An afghan, just completed by her busy fingers, is on exhibition at a church fair. Mrs. Powers shows but few marks of her great age.

© 1890 SCIENTIFIC AMERICAN, INC.

AN IMPROVED MAGAZINE HAND CAMERA.

The accompanying illustrations represent a new hand camera designed to hold a large number of sensitive plates (without metal holding frames or plate holders), and is constructed so that they may be easily, certainly, and quickly changed. The camera is in the form of a box having upper and lower compartments, as in Figs. 1 and 3. The lens and exposing chamber are in lower compartment, while the upper one holds the stock of plates (as many as three and a half dozen, if desired). The division between the two compartments is composed of two sliding boards, one above the other, which move in opposite directions and are propelled by pinions on shafts extending across the camera, as shown in Figs. 2 and 3, with their milled heads on the outside, as in Fig. 2. The division boards enter into grooves at each end of the camera, and thus effectually prevent the light in the exposing chamber from striking the stock of plates above. These plates are kept pushed forward in position by two spring pins, as shown in the right of Fig. 3. The heads of the pins are hook-shaped, and when drawn outward with the fingers and turned to one side, are held by a cam projection in that position, leaving a space behind the plates in which another plate may be inserted. A single spring pin is shown in the lower compartment, Fig. 3.

Pivoted under the center of the lower division board is a leaf-shaped board, the shaft of which projects through the opposite side of the camera box, as observed in Fig. 2. The board is seen in Fig. 1 partly down. Supposing it is desired to bring a plate into position to be exposed, the leaf board is put into the position shown in Fig. 1, then the upper division board holding all the plates is moved backward by rotating the milled head of the shaft outside, which allows the first plate to fall upon the edge of the leaf board as in Fig. 1, guiding it in its fall so that the lower edge will strike the front corner of the bottom of the lower compartment, and lie at angle opposite to that shown. As soon as it has dropped, the sliding division board is pushed back to its original position and the camera is turned with the lens side upward. The back of the plate now rests upon the leaf board, and as the latter is rotated backward or downward, the plate follows it until it lies flat against the back of the exposing chamber; the leaf board is shown up in position after the movement in Fig. 3. The bottom edge of the plate enters a transverse groove in the bottom of the chamber, while the top is clamped by the leaf board, being held out of its recess in the lower division slide by a small flat spring. Before the plate dropped to this position, the single spring pin was withdrawn. Afterward it was released, which pushed the plate forward into the focal vertical plane. The camera is now placed in its normal position and the exposure made. After exposure the camera is reversed from the position shown in Fig. 1, and like that in Fig. 4, the spring pin back of the single plate is withdrawn, then the bottom division board is pushed forward by its shaft from the outside, which allows the exposed plate to drop into the magazine compartment, as shown, and by withdrawing the spring pins respectively, to gradually slide in behind unexposed plates. The lower division slide is pushed back, and the spring pins released, which keep the mass of plates compact and in position. Thus each plate may be passed around from one compartment to the other until all are exposed. Suitable means are provided for keeping tally of the number of plates exposed and also for protecting the lens while setting the shutter. The camera has the usual finder in the top, as shown. The lens may be provided with a rack and pinion movement for varying the focus, but as at present designed a fixed focus is preferred. There is a hinged top lid for opening the camera in the dark room, for removing the exposed and inserting the fresh plates. All the movements are simple, and there is little opportunity for it to get out of order. For further information concerning it, the inventor and patentee, Mr. William A. Brice, care R. C. Poulter, No. 40 Middle Temple Lane, London, England, may be addressed.



BRICE'S HAND CAMERA.

THE law compels no one to do impossibilities.

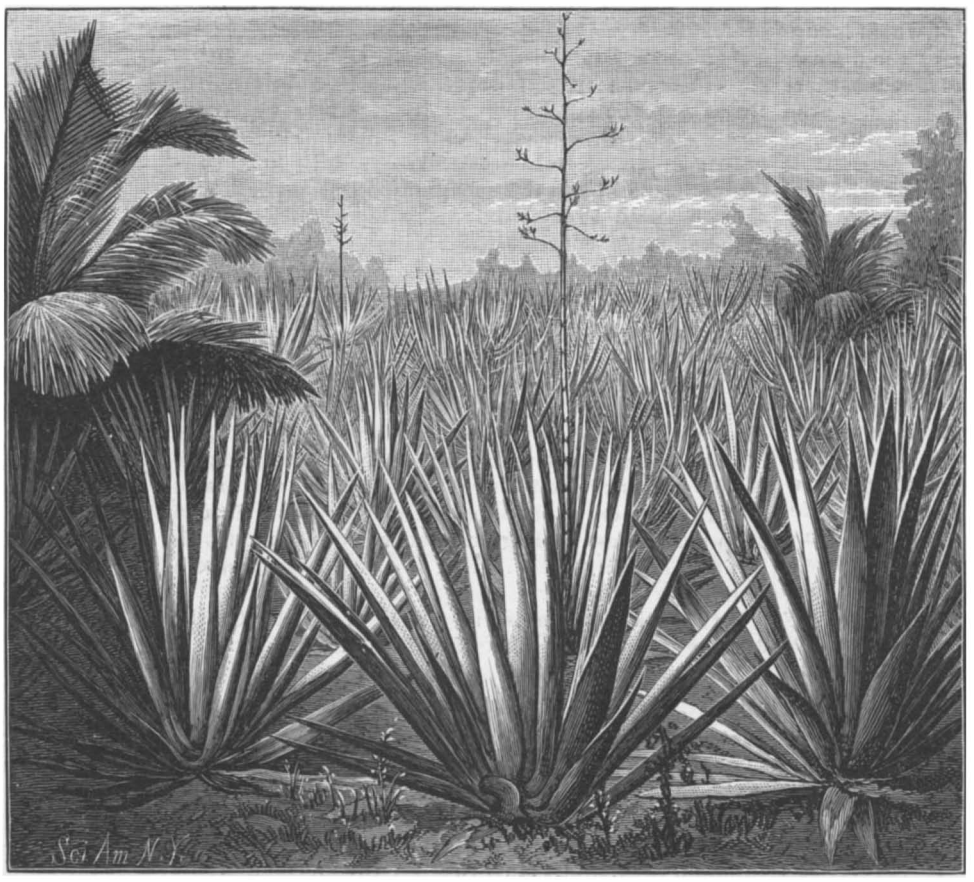
Good Material for Good Mechanics.

The Architect and Builder felicitates itself upon the fact that the sons of professional men dominate in the Philadelphia Public Manual Training School. While the children of artisans are so largely striving to get into the ranks of the struggling and poorly paid professions, the children of professional men are largely taking to mechanical pursuits. Professor William L. Sayre, the principal of the school at Seventeenth and Wood Streets, states: "It is a curious fact that of the boys now in the training school and learning the use of chisels and hammers and lathes, fully three-fourths are sons of professional and business men. We have many sons of doctors and ministers and lawyers." Of the seventy-seven occupations recorded of parents of boys now in the middle class, fifty-four are those of professional or business men and twenty-three those of men engaged in other pursuits, of whom only fourteen are artisans.

THE SISAL PLANT AT NASSAU, N. P.

To the Editor of the Scientific American:

I send you a photograph of the sisal plant, which is now creating a sensation in this region, from the reason of its being in great demand for the manufacture of cordage and rope of a fine quality. It is said to be superior to that grown in Yucatan, and equal to the best manila. The English government pays a royalty on every pound raised in this colony to encourage its production on an extensive scale, and almost every one is either embarking in the enterprise or is already in it. Many strangers from the United States are trying their hand at it, and more are coming by every steamer. Machinery for separating the fiber from the pulp has been put in operation and run by steam, facilitating its preparation greatly. In the beginning it was beaten by hand, making it a slow and expensive way of preparing it. In a year or two things will be booming all through this land of the cocoanut and pineapple, and the natives will leave the wrecking business to cultivate the sisal plant, which will pay them better.



THE SISAL PLANT.

The photograph shows the plant as it looks when ready to cut the outside leaves for use, also the plant gone to seed.

I am told by Captain Lightburn, on whose plantation these pictures were made, that the seedlings on this tree, or stalk, are worth £10, or $48 American currency. Every one is talking of the bright prospects for the near future in store for the people of these islands, as soon as a sufficient area has been brought under cultivation. This is being done as fast as circumstances will admit.

The plant is a native here, and has grown wild for ages probably, its worth being unknown until recently. They used to try and kill it as a worthless weed. After it once gets a fair start it requires no more attention, and will yield its product for from ten to fifteen years, then new plants have to be planted, as the old ones die out. The planter that has a few hundred acres under cultivation can gather the leaves, turn them into cash, collect his royalty from the government, and be as happy as a liberal income, a superb climate, and other favorable surroundings can make him.

To give an idea of the magnitude this industry is assuming, I will state that a gentleman, an Englishman, arrived here a few weeks since and has bought 80,000 acres of land, on three islands of this group, and proposes putting it all into the cultivation of this plant. He pays $4 an acre, £6,000 down and the balance to remain at interest. He wanted to pay for it all at once, but the authorities here would not receive it all, preferring to have it at interest.

Nassau, N. P. J. F. COONLEY.

A Simple Storage Battery.

Get two half-round porous cups and a round glass jar large enough for the two porous cups to stand in upright. Get two plates of sheet lead one-sixteenth of an inch thick, wide enough to fit the half-round side of the porous cups and deep enough to come an inch or so above the top edge of the cups and jar. Solder a stout copper wire or a screw post to each lead plate at the top. Place the lead plates in the cups and fill the cups nearly full with a paste made of red lead mixed with a solution of sulphate of soda thin enough to run like a cement. The glass jar containing the two cups should be filled to within half an inch of top of cups with sulphuric acid and water, about one part of acid to eight parts of water. One plate should be marked X, so that, in charging, the currents will be correctly connected. This may be charged by attaching to a series of a dozen sulphate of copper cells for twenty-four hours, or from a dynamo. It should always be charged in same direction, and it will improve by repeated chargings. A wooden cover may be fitted to the glass jar, and evaporation of the fluid should be replenished by adding water. Two or more cells of this battery will work small motors, lamps, and induction coils, and if thoroughly charged will retain a large volume of electricity for considerable time. After once being well charged, four to six cells of sulphate of copper battery will recharge it.—*Journal of the Telegraph.*

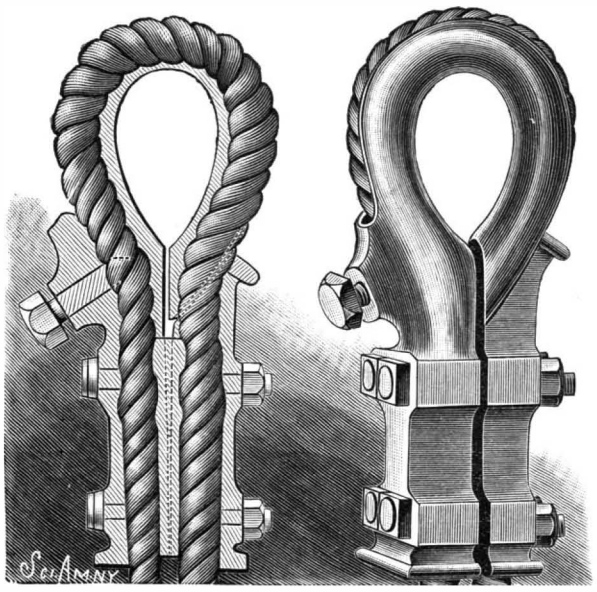
Japanese Lacquer.

Mr. R. Hitchcock says that the use of Japanese lacquer deserves more general attention. "It gives a surface to wood much harder than the best copal varnish, without brittleness. It takes a polish not to be excelled, which lasts for centuries, as we may see in the old treasures of Japan. It is proof against boiling water, alcohol, and, indeed, it seems to be insoluble in every agent known. It is the best possible application for laboratory tables. I have a set of photographers' developing trays that have been in use for more than a year, and I find them excellent and cheap. In Japan it is used for many household articles."

© 1890 SCIENTIFIC AMERICAN, INC.

AN IMPROVED ROPE CLAMP AND THIMBLE.

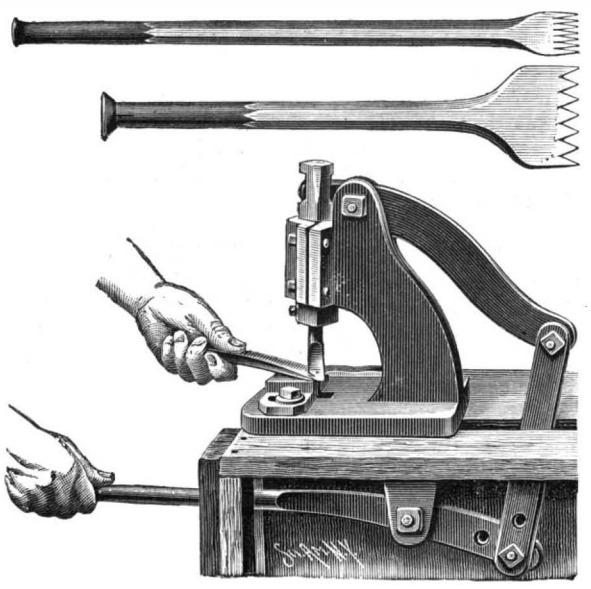
The accompanying illustration represents a strong and inexpensive device, which may be quickly connected to the end of a rope, either of hempen or wire strands, and will afford a thimble or lining ring for the looped end of the rope, with convenient and reliable means for the attachment of the rope thereto. This invention has been patented by Mr. John J. Young, of No. 1162 Erie Avenue, Williamsport, Pa. The main portion of the device is cast in the form of an elongated shell having a rounded channel from the rear to the point where the ovate thimble commences, the latter being an integral extension of the main section. This thimble portion may be made continuous as a solid ring integral with the main section, but is preferably terminated to leave a slit at the apex of the ovate thimble, a clamp section being adapted for adjustment over the apex of the thimble section. A ring may thus be readily inserted in the ovate portion if desired. Upon the outer surface of the main section, near where the thimble commences, is an inclined projecting boss, that receives a threaded set-screw bolt, the conical point of which is embedded in the rope when the clamp and thimble are made fast thereto. A wedge-shaped loose spreading block is inserted between the lapped portions of the rope, the block having protuberances corresponding with grooves in the clamping sections, whereby, when the sections are clamped together, the rope body is forced into the grooves and securely locked fast to the thimble clamp.



YOUNG'S THIMBLE AND ROPE CLAMP.

AN IMPROVED TOOL CUTTER.

The accompanying illustration represents a machine intended especially for cutting or dressing the toothed chisels used by marble and stone cutters, etc. It provides, in connection with a punch, a die made in sections and adjustable to suit different sized punches. The invention has been patented by Mr. Floyd G. Smith, of Buckhannon, West Va. Each die section has on its meeting side what may be termed a fulcrum point, and it has a bolt slot preferably curved on an arc approximately centering at this fulcrum point. The cutting edges of the sections are arranged to the rear of the fulcrum, and incline outward therefrom, the angle of divergence of the edges of the sections being varied by adjusting the sections on the fulcrum as may be desired. Different punches are used to form the different angles of teeth, the angle of the punch being fixed or invariable; but when the die is adjusted by rocking its edges upon the fulcrum, it is secured in position by screws, and is thus capable of adjustment to fit any sized punch, and adapted for use in making any sized tooth, from the most delicate carving tool to the largest sized cutting tool. The punch is preferably grooved and curved at its cutting end, and works after the plan of a pair of shears, the edges of the punch acting against the edges of the die and operating to cut a clean, smooth tooth, that needs little or no after dressing or filing.



SMITH'S TOOL CUTTER.

The Farmer a Skilled Laborer.

Viewed from the lofty standpoint of the New York Hodcarriers' Union, considered from the hall of the Philadelphia Billposters' Protective Association, the prairie farmer is simply a clodhopper. He is a man who decides to have corn, wheat, and potatoes, instead of wild grass, grow on a certain piece of land, and plants the seed that will produce them. In point of fact, more knowledge and skill are requisite for prosecuting his craft than that of any city artisan. It requires more skill to handle a plow than a trowel. It is more difficult to manage a reaping machine than a machine that turns out brick. Greater knowledge is needed to sow grain than to move switches in a freight yard. Much more information, experience, and skill are needed to raise tobacco plants, to cultivate them, and properly to cure the leaves, than to make them into cigars. Laying drain tile is a more difficult art than laying brick. Properly to remove a fleece from a sheep demands as great dexterity as to shave the beard from a face. The successful farmer is necessarily a skilled laborer. He is master, not of one trade, but of many, and a long time is required to learn each of them. He is also a merchant, and to be prosperous he must be a judge of the quality of many things, and know how to buy and sell them to the best advantage. —*R. Welch, in the Forum.*

AN IMPROVED REVOLVING HORSE HOE.

The accompanying illustration represents an implement especially adapted for cutting weeds, stubble, etc., and for pulverizing the soil. It has been patented by Mr. Ard G. Emery, of Marydel, Saline County, Kansas. The main axle or drive shaft is journaled at about the center of the main frame, and to the inner face of the road wheel is secured a casing in which are two spring-actuated dogs adapted to engage a ratchet wheel on the main axle when the implement is drawn forward. Centrally upon the axle is secured a box, and upon this box is mounted the hub of a master wheel, provided with internal teeth. Forward of the main axle are two transverse shafts, each having a rigidly attached pinion adapted to mesh with the internal gear of the master wheel. Upon each of the transverse shafts, near their outer ends, is secured a downwardly curved rod or bar, the hoe shaft being journaled in the lower ends of these rods, the hoe shaft having, near each end, a small sprocket wheel connected by chain belts with larger sprocket wheels on the transverse shafts in advance of the main axle. The hoe shaft is normally held at a distance above the ground which is regulated by a standard attached to each end of the shaft, and projecting upward through an eye on an end bar or rod of the frame. The hoes consist of polygonal metal plates, there being upon four or more opposed edges of each plate an angled digging blade, and above each digging blade a cutting blade, the latter severing any weeds and the digging blades turning up the soil as though a regular hoe were employed. The hoe-carrying shaft can be readily raised and lowered at will by means of a lever within easy reach from the driver's seat.

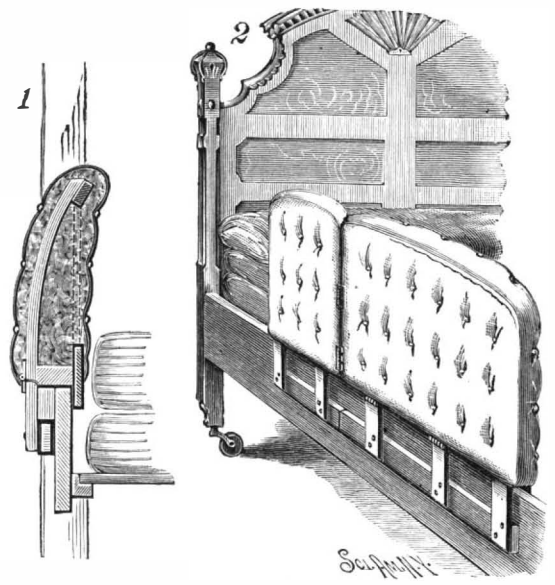
EMERY'S REVOLVING HORSE HOE.

To Abort a Boil.

A writer in the *Wien. Med. Wochenschr.* states that a boil may be aborted by simply scraping the skin over the threatened seat of invasion with a scalpel until a drop or two of blood exudes on pressure.—*College and Clinical Record, October*, 1889.

A REMOVABLE SIDING FOR BEDSTEADS.

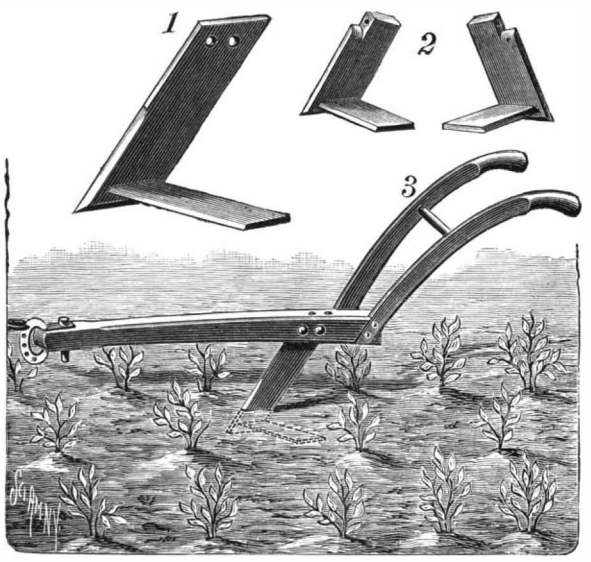
The accompanying illustration represents a means of providing ordinary beds with padded sides that are removable when not required for use, the bed being readily accessible when the sides are in position. The invention has been patented by Mr. Claus H. Blanken, of No. 71 Washington Street, Charleston, S. C. Fig. 2 represents the application of the device, Fig. 1 being a sectional view. The main portion of the side frame, which is a rectangular slatted structure formed of wooden strips, is hinged to a pendent clamping frame intended to bear against the bed rail, its lower longitudinal bar being padded to prevent injury to the rail. Upwardly projecting arms with spring hinges are attached to the clamping bar, and upon the inner edge of the lower rail of the slatted frame are depending finger pieces, having a bearing upon the inner surface of the side rail of the bed. The slatted frame is upholstered and padded, to afford a neat finish and cushioned surface. Near the head of the bed a short section of the removable siding is hinged to the main portion, the swinging open of the short section affording an opening for the ingress and egress of the occupants of the bed. By means of its spring-actuated clamping frames, the device can be quickly adjusted in place, and readily removed by a lifting movement, while a secure adjustment is afforded.



BLANKEN'S REMOVABLE SIDING FOR BEDSTEADS.

AN IMPROVED CULTIVATOR.

A cultivator especially adapted to the cultivation of young cotton plants, and also designed for use with other crops, such as cane, beans, peas, and potatoes, is illustrated herewith, and has been patented by Mr. Leroy Bell Henry, of Austin, Texas. There is bolted to the beam a vertical blade, with a sharpened forward and bottom edge, and to this blade is rigidly connected a laterally extending wing having a forward cutting edge, as shown in Fig. 1, the wing being secured to the blade so that the latter extends some distance below the wing. Fig. 2 illustrates modifications in the form of the wing and blade, which may be made of different sizes for one or two draught animals, and may be either right or left handed. As the implement is drawn forward, as shown in Fig. 3, the blade is guided closely to the plants being cultivated, the cutting edges of the blade and wing removing the weeds and loosening the earth without disturbing the roots of the plants. The inventor claims that the use of this implement in the cultivation of cotton plants will obviate the necessity of two-thirds of the amount of hoeing ordinarily necessary, the only work left to be done by the hoe being the thinning of the plants.



HENRY'S CULTIVATOR.

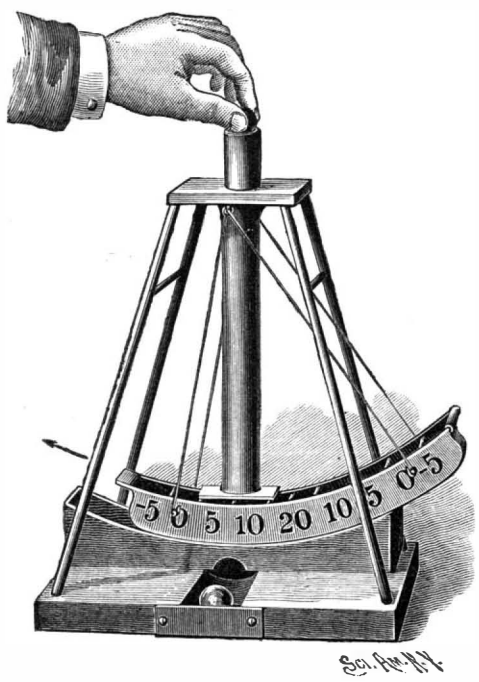
© 1890 SCIENTIFIC AMERICAN, INC.

The Care of the Teeth in Childhood.

The importance of attention to the teeth of children, not only for their immediate comfort, but in view of their future benefit—an importance we have repeatedly urged—was again emphasized in a valuable paper read by Mr. Francisco Fox at a meeting of the Medical Officers of Schools Association. He said that doubtless many of the dental troubles of adult life are due to a careless disregard of the teeth when first erupted and during the earlier years of life, and that much might be done to combat deleterious influences, especially at that important epoch, the time of second dentition. Caries of the deciduous teeth, the deposition of tartar, which has a particularly destructive power, forming a nidus for the growth of bacilli and leptothrix, and rapidly disintegrating the enamel, and alveolar abscess of the temporary teeth, should each be carefully treated. A point which Mr. Fox especially insisted upon was the too frequent neglect of irregularities of the permanent teeth, which are not only disfiguring, but from the increased and continuous pressure upon contiguous teeth, and the difficulty of keeping their surfaces clean, constitute a most frequent cause of decay and early loss of teeth.

AN IMPROVED GAME APPARATUS.

An amusing and instructive game apparatus, illustrating the principles of gravity and oscillation, and affording opportunity for the exercise of skill and judgment, is shown herewith, and has been patented by Mr. Frederick Pries, of Florence, Neb. A curved car, preferably formed of sheet metal, is suspended from the top plate of the frame by stiff wires, with hooks at their lower ends to engage screws attached to each side of the car near its ends, so that the car may swing freely like a pendulum. The car is open at the top, and there is a hole centrally in its bottom in vertical line with a tube fixed in the top piece, this tube having a flange on its lower end to prevent the ball used in the game bounding out of the car. The car has a false bottom, consisting of a strip of sheet metal bent to the proper shape and suspended therein to leave a space between it and the true bottom somewhat less than the diameter of the balls used. This strip of metal has one of its ends formed into a hook to engage one end of the car, while the other end of the strip is extended to be used as a handle, the strip being thus suspended in the car by its ends. At frequent intervals on the upper surface of the strip are vertical partitions forming cells, in the bottom of each of which is a hole large enough to permit the entry of the ball, but the central cell is cut all around. Beneath the car and attached to the base plate is a narrow receptacle connecting with a central groove in the base plate inclining toward the front. In order that the car may not swing too far, the frame is made with side cross pieces or stops, against which the wires will strike. The game consists in an effort to drop the ball through the tube, and through the central holes in the false and the true bottoms, so that it will come out at the front



PRIES' GAME APPARATUS.

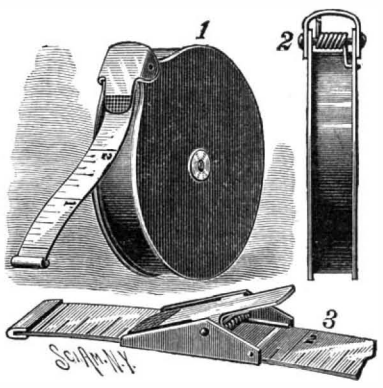
through the central groove, while the car is swinging. A number indicating the highest count is placed opposite this cell, the cells removed therefrom being numbered to indicate counts proportionately less, the end cells being represented by a minus or losing count. A modification of this device provides for the swinging of the tube as a pendulum while the car remains stationary.

Why the Japanese Stoop.

Dr. Kidera Yasuatsu has been inquiring into the cause of the habitual stoop of the Japanese, and concludes that it is due to their excessive politeness, the bent posture being considered one of deference.

AN IMPROVED TAPE MEASURE.

The accompanying illustration represents a tape measure on which slides an indicator adapted to retain itself at any point on the measure by frictional contact, produced by a spring-actuated plate pivoted in the main body or frame of the indicator. It has been patented by Mr. Thomas W. Grierson, of St. Paul, Minn. Fig. 1 shows the application of the device to an ordinary tape measure and its box, of which Fig. 2 shows an end view. Fig. 3 represents the device applied directly to the tape. The indicator is attached to the box by a pivot passing through the edge flanges of the box, and its point is pressed into contact with the tape by a small spiral spring on the pivot, so that the tape will be held at any point to which it may be drawn out, until the point of the indicator is released from the tape by pressing down upon the opposite end of the indicator plate. In applying the device directly to the tape the indicator proper is pivoted in a supporting frame through which the tape is passed, the tension of the spring being sufficient to retain the indicator at any point at which it may be placed on the tape, the indicator being passed along on the tape to the point desired.



GRIERSON'S TAPE MEASURE.

The American Bison.

Mr. Plumb, of Kansas, in the Senate, and Mr. Peters, of the same State, in the House, have introduced measures setting apart a tract in No Man's Land for the propagation of buffaloes. Mr. Plumb goes to the extent of proposing to reserve for that purpose during twenty years all the land in the so-called neutral strip, on the border of Texas, by leasing it to Mr. C. J. Jones, of Kansas, who has already a herd of bisons and cross-breeds, and would put it on the reservation.

Last spring Mr. Satterthwaite, making up an estimate from his personal observation and from information which was furnished to him, concluded that there were fewer than three hundred buffaloes within the Yellowstone Park, and not more than three hundred in the whole United States outside of that tract.

Correct or not, this is detailed counting, and, at all events, no one questions that only a remnant of the millions of this fine race of animals is left. Hide hunters and sportsmen have been fatal to it, when the subsistence which it furnished for uncounted generations of the Indians of the continent left its enormous numbers not materially impaired. The extent to which the aborigines were dependent on the buffalo and a few other animals for their supply of food was shown by Gen. Sherman's proposal, in the days when the idea was current of an impending conflict between the red men and the white, to bring the former to terms by making war on a grand scale upon the buffalo and exterminating it. It was too soon evident that this organized attack would have been superfluous. The wanton slaughter of buffalo, elk, and antelope throughout the West speedily reduced many Indian bands almost to starvation, and they became mendicants, supported on the government reservations.

Col. Dodge once declared that in the years 1872, 1873, and 1874 alone "more than five millions of buffaloes were slaughtered for their hides." This statement may be difficult to believe; but it is certain that during ten years after the close of the civil war a prodigious slaughter of these animals occurred. Hunters for skins to sell were helped in their work of destruction by British tourists and others who merely sought to kill as many as possible without even taking away the hides. Yet more than half a century ago Congress prohibited by law the reckless slaughter of game in the Territories; and the extermination of the buffalo has been carried on in violation of that statute. The animal was destined, of course, to gradually retreat and disappear before the march of settlement, but indiscriminate and wanton destruction settled its fate generations too soon.

The Invention of Artificial Silk.

The recent development of the production of artificial silk by M. De Chardonnet, in France, has excited much interest. We have received several communications from Mr. David Baldwin, of Midland Park, N. J., who, as far back as 1871, had worked in the same direction. He claims to have succeeded in producing a cellulose fiber which he combined with tannic acid and other substances in his attempts to increase its tensile strength. Four or five years ago Mr. Baldwin made known his project to a silk manufacturer, Mr. Thomas Holt, but who, not being a chemist, did not care to experiment in that direction. The matter therefore lay in abeyance. Now France comes forward as the fatherland of an invention apparently conceived of in America. The story is an old one. An inventor must perfect his invention and patent it to obtain the recognition of the world. As a matter of history, we feel that the above is an interesting statement of facts. The French invention is described in our SUPPLEMENT, No. 707.

Cruel Business.

The practice of thrashing the patient ox to increase his speed, or whacking him across the nose when he is desired to stop, is certainly not the characteristic of a good teamster, any more than the habit of yanking, twitching, and whipping the horse is the indication of a good driver. If a man addicted to this method of driving will harness himself to a rig, and with his eyes blinded, a harsh bit in his mouth, and a person with the reins and a rawhide behind him, who, when he wishes him to start, gives him a cut with the rawhide, when he would have the speed increased gives him several additional cuts, and when he wants him to stop yanks the reins with force enough to nearly break his jaw, he will appreciate this style of driving, and knowing how it is himself will doubtless correct his method.

There is nothing more unreasonable or wasteful than this style of managing horses. Good sense requires that a horse be started, urged forward, and stopped by the voice, and that resort should never be had to the whip unless absolutely necessary. A horse then knows what is required of him, and the annoying and dangerous habit of suddenly starting and jumping is avoided. A great majority of the spavins, sprains and ringbones, not to speak of the heaves and numerous other horse ailments, are caused by this rough and thoughtless driving.—*The Clay Manufacturers' Engineer.*

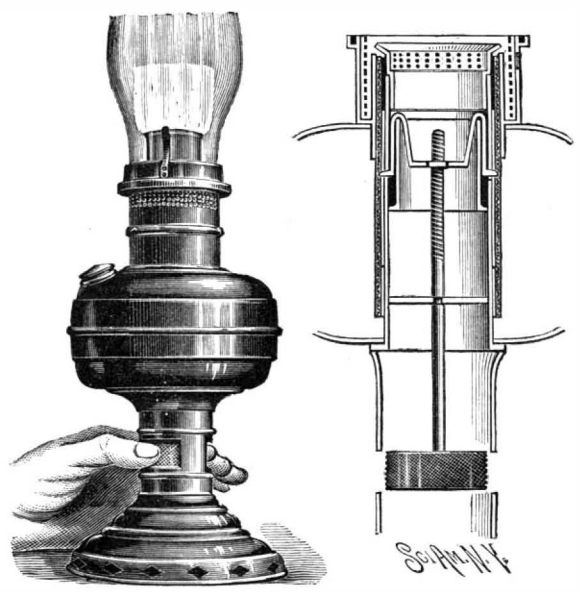
Horseshoes and Roadways.

The horseshoe of the present should be improved. There needs to be something which will save the hoof from an undue wear and breakage, while at the same time permitting of elasticity of movement when the weight of the body is alternately borne upon and taken from it.

The *World* suggests that an improved roadway is needed in this climate; something that will wear as well as stone, be as easy to pull on as asphalt and give the horses' feet a good grip, so that they will not slip even in rainy weather.

AN IMPROVED LAMP.

A lamp having a central-screw wick-lift, giving complete control of the flame, and whereby the wick is raised evenly, without fraying and twisting, as so commonly occurs in the ordinary lamp, is shown herewith, and has been patented by Mr. Charles H. Grube, of Robinson, Ill. The bowl of the lamp has an open central aperture, the stem below the bowl being open at its sides to give access to a centrally journaled turn-screw extending up within the aperture, the threaded portion of the screw passing through a nut or body from which radiate arched or recurved stems. The ends of these stems move vertically in narrow slots of the interior tube lining of the aperture, the points engaging the wicks, whereby the wick is raised or lowered



GRUBE'S LAMP.

with the utmost precision by the turning of the screw. Exterior to the wick is a surrounding tube, extending from near the bottom of the reservoir upward to the flame base, where an internal collar is set snugly fitting the interior aperture tube, the collar being perforated around its upper portion, and having an annular flange projecting outwardly over the wick aperture. There is also an external perforated collar, a little slide in which covers an aperture into which a lighted match can be introduced for lighting the lamp without removing the chimney. This wick lift is so distant from the flame that it is always cool, and the construction prevents any overflow of oil down the center of the lamp.

© 1890 SCIENTIFIC AMERICAN, INC.

Correspondence.

Marking Zinc Plant Labels.

To the Editor of the Scientific American:

A very simple and entirely satisfactory method that I have practiced for thirty years past is to write on them with a black lead pencil. A few hours after the writing is made it becomes fixed and cannot be removed except by the use of an acid or by scouring. The zinc should be slightly oxidized before the lettering is done. For marking trees, the labels should be tapered at one end, so that they may be easily wound around a branch.

For marking rose bushes, herbaceous plants, and other things to which a label cannot be attached, I use a light iron rod with a loop at one end, to which the label is fastened by copper wire.

In one form or the other these labels may be used for everything that requires marking in the garden or the orchard. I send you samples of each that have been in use out of doors from six to ten years, to verify my statement of their indestructibility. J. R. S.

Rahway, N. J., February, 1890.

[The specimens were received, and are excellent.—EDS.]

A Large Meteor.

To the Editor of the Scientific American:

In answer to L. B. Wilson in your issue of February 15, I can report a remarkably brilliant meteor seen here a little before 9 o'clock, on the evening of January 24. A day or two after, it was reported in the Texas papers that a large meteoric stone weighing several thousand pounds had fallen at that date on Comanche Peak in Johnson or Hood County. When the meteor first appeared, it seemed to rise a little north of east, moving slowly and making light like a rocket, as described by Mr. Wilson. When nearly overhead it threw off two pieces, one larger than the other. For a minute period of time the meteor appeared to stop or waver in its course. The smaller piece was almost immediately extinguished; the larger one seemed to be thrown back in the meteor's path, and shot a considerable distance before it disappeared. The main body of the meteor proceeded toward the southwest, and was hidden from my view by trees. After the first explosion it threw off a number of sparks. The night was very misty and cloudy.

R. M. CHINN.

Brazoria, Texas, February 19, 1890.

Our Warm Winters and the Gulf Stream.

To the Editor of the Scientific American:

The inclosed clipping from the *Hawkeye*, by C. C. Blake, Kansas, will explain itself. Please inform the readers of the SCIENTIFIC AMERICAN whether there is any truth in the statement that the Gulf Stream has changed its course within the last two years. If so, is the change periodical, or can it be accounted for?

W. H. HURLBUT.

It is now pretty generally known that the Gulf Stream has been hugging the American coast from Florida to Newfoundland more closely than ever known before. Ordinarily a cold current from the coast of Labrador flows between the American coast and the Gulf Stream, extending as far south as Cape Hatteras, where it sinks under the Gulf Stream. But recently the near approach of the Gulf Stream to the American coast has cut off this cold current and stopped it at the Grand Banks of Newfoundland. It is difficult to conceive of any adequate cause for this great change in the mighty ocean current known as the Gulf Stream. I know of but one cause that could have produced it, and that was the great earthquake at Charleston in 1886. We know that a slight thing will cause the Missouri River to change its channel. At first no effect will appear, but gradually the current begins to change, and in a year or two the main channel has changed half a mile or more. It is not probable that the earthquake produced any serious upheaval in the bed of the ocean off Charleston, but it is quite possible that the tidal waves produced in the ocean by the earthquake may have started a change in the course of the Gulf Stream, and that it took about two years to effect the change. It is a well-known fact that the winters in at least the eastern half of the United States have gradually become more mild ever since the time of the earthquake. If the rocks under the bed of the Gulf Stream were thrown up by the earthquake in such a way as to have caused the change in its current, then the change will be permanent, and a great change has occurred in the whole climate of a great part of the United States. But if only a little mud was thrown up, it will soon wear away and allow the current to assume its former channel. But I think it more probable that no material change was made in the bed of the ocean. It would seem that the tidal waves produced by the earthquake were sufficient to seriously disturb the current of the Gulf Stream off Charleston. This deflection being started, it would take a long time to entirely change the direction of such a large current. From all I can learn in regard to it, I think the current was gradually bending to the west till it reached its maximum in the early part of 1889, then, remaining apparently stationary for some months, it began to recede last fall, and is now going away from our coast quite rapidly. Probably it will be back to its former channel within a few months. As soon as it swings east of the Grand Banks, the cold Labrador current will be able to resume its normal position, and if this is done during February, as I think probable, the cold weather will extend to New York City before the end of February.

On the principle that similar causes produce similar results, this winter should have been a very cold one from the Rockies to the Atlantic. There is no instance within the past hundred years when astronomical causes similar to those which now obtain did not produce very cold winters in the United States. This winter would most unquestionably have been a very cold one but for the great change in the direction of the Gulf Stream. In making my weather calculations, I figure upon the basis that the mountains, valleys, and ocean currents will remain unchanged. But if an earthquake should change any of these, a corresponding change in the climate must ensue. For twelve years prior to the Charleston earthquake I calculated the weather for each month, and hardly ever made a serious mistake. Such errors as I have recently made have been due to the long train of effects produced by the earthquake. But it has been a blessing in disguise, as last summer would have produced the most disastrous drouth of the century had it not been for the influence of the near approach of the Gulf Stream. As it now seems to be returning to its normal position, I have no doubt but that the predictions of weather for the remainder of 1890 will be very nearly correct.

While it is true that great convulsions of nature may occur at any time, yet it is not probable that another like the Charleston earthquake will occur within a hundred years. It is not wise to expect such things, and all science can do is to go upon the hypothesis that nature will pursue the even tenor of her ways with only the ordinary fluctuations, which can be calculated in advance. The extraordinary change in the Gulf Stream is a fact. That fact must be accounted for; can it be accounted for upon any other hypothesis than that the change was started by the Charleston earthquake? The winter has been cold in the northwest, and cold and very stormy off the coast of Newfoundland, where the changed Gulf Stream met the cold Labrador current. This is attested by all the steamers arriving from Europe. The weather at all points has acted as we should have expected if we had known that the Gulf Stream was going to make this change.

The present January thaw extends to the far West, but it will not last long. It was predicted in my book for this year. This thaw is independent of the mild winter in the East, which was caused by the Gulf Stream. C. C. BLAKE.

[The statement of Mr. C. C. Blake is a fair theory for the past two winters, but does not account for the movement of the Gulf Stream in past warm winters when the temperature of the cold coast current has been observed to be abnormally high. Maury, in his "Physical Geography of the Sea," likens the Gulf Stream to a great pendulum swinging to and fro to the south and to the north; and marking upon the chart the southeastern point of Newfoundland as its most northern limit of vibration. When it touches this point, the northeastern cold current is shut out from circulating down our eastern coast and thus modifying our coast temperature.

There is no cause assigned for its vibration other than the irregularity of the general movement of the waters of the globe, as kept in circulation by the revolution of the earth and the unequal temperature of the oceans.]

Uncle Sam's Border Line.

For many years the question of boundary between the United States and the possessions of Great Britain was discussed, and at last, at the Convention of London held in 1818, the forty-ninth parallel of north latitude was decided upon. A parallel of latitude, however, being an imaginary line, is a very poor guide to a traveler. So the next thing to do was to mark that line so that all who pass that way should know where it was located. Accordingly the country in that vacinity was surveyed, and monuments were set up at even mile intervals, the British placing one between every two of ours. These extend from the Lake of the Woods to the Rocky Mountains. M. Louise Ford, in the February *Wide Awake*, tells how the boundary line is defined.

Where the line enters forests the timber is cut down, and the ground cleared a rod wide; where it crosses small lakes stone cairns have been built, sometimes being eighteen feet under water and eight above; in other places earth mounds seven by fourteen feet have been built.

The most of these monuments, which number three hundred and eighty-eight in all, are of iron. It was found that the most solid wooden posts were not proof against the ravages of the Indians, prairie fires, and the weather, so that nothing but iron would do.

These pillars are hollow iron castings fitted over solid cedar posts and well bolted through, and are sunk four feet in the ground.

They are eight feet high, eight inches square at base and four at top, and upon opposite sides facing north and south are the inscriptions cast in letters two inches high: "Convention of London" and "October 20, 1818."

The pillars weigh two hundred and eighty-five pounds each and were made at Detroit, Michigan. So you see Uncle Sam's border line is very distinctly marked all the way from the lakes to the summit of the Rocky Mountains.

Prediction of Weather.

M. Luigi Palmieri, the learned director of the observatory of Vesuvius, has made himself a specialist in questions appertaining to the electricity of the earth. For some forty years he has studied this question, and has published various papers and more than a hundred notes or memoirs. Unfortunately for science, he has thought well to publish them, not only in Italian, but in local papers having naturally a restricted circulation. Dr. Albert Battander gives, in *Cosmos* of 25th January, a *resume* of the results obtained by M. Palmieri, which bid fair to prove of considerable importance, if not in the field of electrical engineering, in that of meteorology and the prediction of weather. M. Palmieri indicates, first, that the potential of objects which exceed the height of the surrounding earth differ from it in sign, in fair weather being negative, and positive only when rain, hail, or snow fall within a certain distance of the observations. Secondly, the electricity of objects exceeding in height the surface of the earth is not their own, so to speak, but is due to the induction of the atmosphere.

He indicates, for example, that if Vesuvius were negative while Naples below were positive, and this were due to different disposition of electricity on their surfaces, the two would tend to flow together and equalize, whereas this is found not to be the case. The electricity is, therefore, due to induction, and is so maintained while the inductive influence is steady, changing as it changes. M. Palmieri has repeated his experiments some thousands of times since 1850 in varied manners to eliminate errors, and he satisfactorily proves that the electricity of the air is contrary in sign to that of the earth. The electricity of the earth is positive and that of the air negative. He gives two experiments showing the influence of the natural changes in the atmosphere. A platinum cup, filled with water and thoroughly insulated, is connected to the plate of condenser electrometer, the whole exposed to the sun's rays. The evaporation reveals the presence of negative electricity. Inversely, if the same cup is filled with snow, the dew which is formed produces signs of positive electricity, the conditions of success in the experiment being the use of the condenser, on account of the feebleness of the potential, and the most careful insulation of platinum cup. The question of the effect upon the electricity of the air, of plants, trees, or of the sun, has also been carefully studied, and if it is objected that these discussions are purely in the field of speculation, M. Palmieri responds that in these electrical indications we should feel the most sure means of the prediction of weather. In fact, according to the director of the Vesuvian observatory, we must discard our old friend the barometer as the indicator of weather changes, which cannot achieve more than 80 per cent of success in prediction, and take the electrometer, which never is found in default. He argues for the extension of electrometer observations at numerous stations with instruments standardized to the same measure, adapted with methods of testing the varying layers of atmosphere, and believes the time of absolute prediction of weather to be no longer an unrealizable, Utopian dream.—*The Electrical Engineer.*

Agricultural Prices.

United States Senator Teller in a recent debate contended that agricultural depression is not confined to the United States. It prevails in all the countries of the world except France. A recent parliamentary inquiry has shown that the British farmers have within twelve years sunk more than half their capital. The trouble is neither free trade nor protection. Since the United States resumed specie payment in 1879, there has been a continuous drop in the prices of farm produce. The wheat crop of this year, with only a difference of 8,000,000 bushels in quantity, was $180,000,000 in value less than the wheat crop of 1880. The corn crop of this year was 500,000,000 bushels more than that of 1882, but it brought the farmers less. Evidently the American depression, great as it is, is far less than the European depression, whatever the cause of the depression may be.—*Milling World.*

A WOMAN who knows it to be a fact says some men will get up out of bed at night in the coldest of winter weather to go to a fire, who cannot be induced to get up at 7 o'clock to start one in the kitchen stove.

© 1890 SCIENTIFIC AMERICAN, INC.

RAILWAY PRACTICE IN AMERICA.

The art of railroad building has received a peculiar development in the United States. The necessity for low original cost of roads has necessitated many expedients, some of which from their ingenuity may be regarded as triumphs of engineering. In the mountainous regions of the West the natural and economic conditions were such as to evolve some very remarkable operations. Several of these are shown in the illustrations, for the use of which we are indebted to "The American Railway," Charles Scribner's Sons publishers.

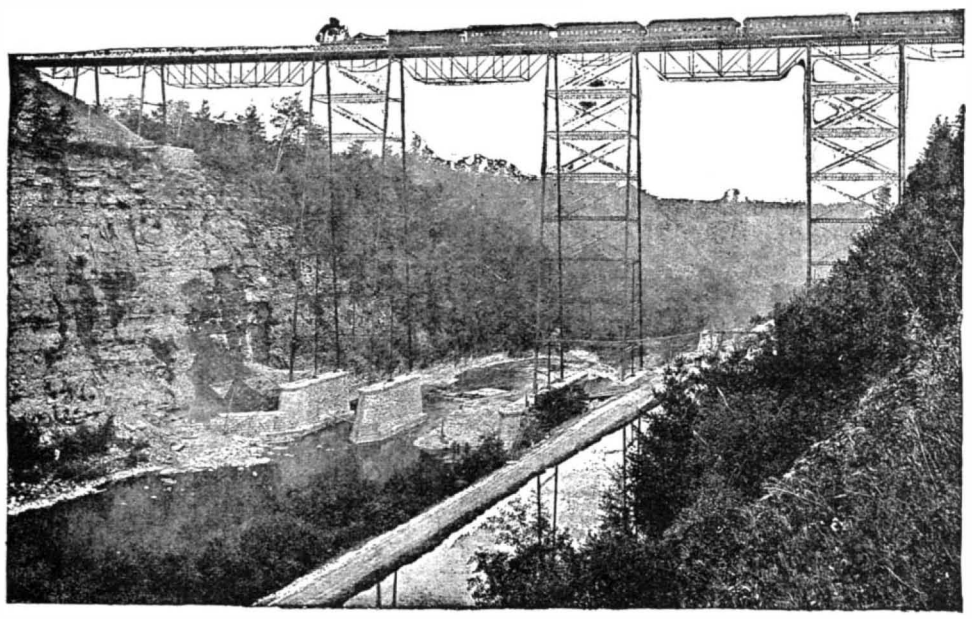


Fig. 1.—THE NEW PORTAGE VIADUCT, N. Y., LAKE ERIE & WESTERN R.R.

The new iron viaduct on the New York, Lake Erie & Western Railroad, at Portage, N. Y., shown in Fig. 1, is an excellent example of plain truss work. Formerly the valley was crossed by a wooden viaduct. This structure was 800 feet long, 234 feet high, and contained over a million and a half feet, board measure, of timber. It was finished in 1852, and in 1875 was destroyed by fire. The piers were 50 feet apart. The graceful structure shown in the cut has taken its place. It comprises ten spans of 50 feet, two of 100 feet, and one of 118 feet. It is composed of Pratt trusses. The iron columns taken in groups of four form towers 50 by 20 feet on the top. From masonry to rail the columns are 203 feet 8 inches high. There are over 1,300,000 pounds of iron in the structure, or not far from one pound of iron to each foot of timber in the old bridge.

The typical American system of constructing such bridges depends upon pin fastening. The individual members are completed at the factory. None are over a few tons in weight. One by one they are hoisted into place. At each end eyes have been formed, and as the members reach their places, bolts or pins are passed through the eyes to secure them. In England the opposite system is generally used. Bridge work is riveted in place. The great Forth bridge was to a great extent built *in situ*. An American bridge is built at the iron works, perhaps a thousand miles away from its final location, and is carried in pieces to its site.

The cut, Fig. 3, shows the big loop upon the Georgetown, Col., branch of the Union Pacific R.R. Two points at a direct distance of 1¼ miles, with a gradient of 480 feet per mile, are connected. The grade is overcome by adopting the remarkable course shown. The curved route is 4 miles long between the two points in question, and the grade is reduced to an average of 150 feet per mile. At one point the road passes on a trestle directly across its own line at an elevation of many feet above it. This can be seen in the background, and in the preceding cut, Fig. 2, a closer view of the curved viaduct is shown. America affords few more striking pieces of railway engineering than this four miles of road.

Another view, Fig. 4, shows a somewhat similar roadway, where the South Park & Pacific Railroad slowly climbs up the hills near Denver. Successive tiers of road are seen, one above the other, on the hillside. The view is taken from Rocky Point, near Denver.

In the next illustration, Fig. 5, an interesting illustration of iron cantilever railway bridge construction is shown. The word cantilever is derived originally from the Vitruvian term *cantilabrum*, or "lip of the rafter." Its invention may be carried back to a very primitive period. A typical cantilever bridge consists of two gigantic brackets, one carried out from each side of the space to be spanned, until they meet each other in the center. They are sustained by being anchored back, or by balancing, or by both. Generally the two brackets termed cantilevers stop before they meet, and the gap between them is bridged over by a truss. A moment's consideration of the strains shows that in a cantilever the strain is the reverse of that in a truss. The upper chord is in tension, and the lower one in compression. Hence, taking a full cantilever and truss bridge, we find on each side a portion where the upper chord is in tension, while in the center truss it is in compression. It is necessary, therefore, that there should be some measure of disconnection between the cantilevers and truss, and this is sometimes brought about by cutting the lower chord between cantilevers and truss.

The first railroad cantilever bridge ever built was constructed by C. Shaler Smith, C.E., on the Cincinnati Southern R.R., over the Kentucky River. The illustration, Fig. 5, shows the work in progress, and exhibits well the boldness of the conception. All supports from below, called falsework, are abolished, and the structure is pushed on in mid-air, member by member. The gorge crossed is 275 feet deep and 1,200 feet wide, and the river is subject to freshets rising sometimes 55 feet. It has been known to rise 40 feet in a single night. The bridge includes three spans of 375 feet each. At the time of its construction it was the highest railway bridge in the world, the trains passing over it 276 feet above the river bed. Each iron pier is 177 feet high, resting on stone foundation piers. The four legs determine a base 71½ × 28 feet. Turned pins, 12 in. diam., are placed on each side of the top between pile and truss. The base of the pier rests on double roller beds, so that every provision for expansion and

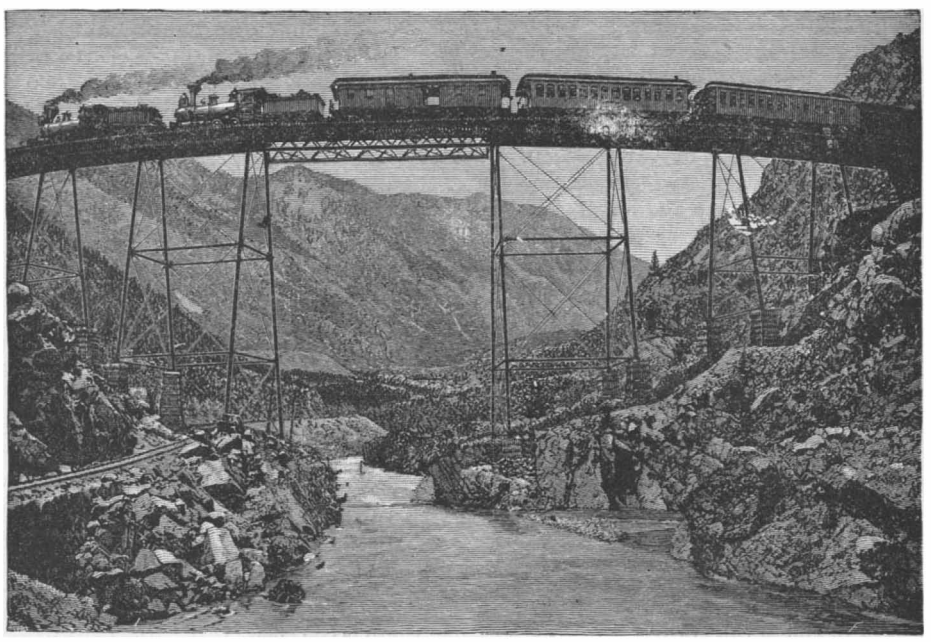


Fig. 2.—CURVED VIADUCT ON GREAT LOOP OF UNION PACIFIC R.R.

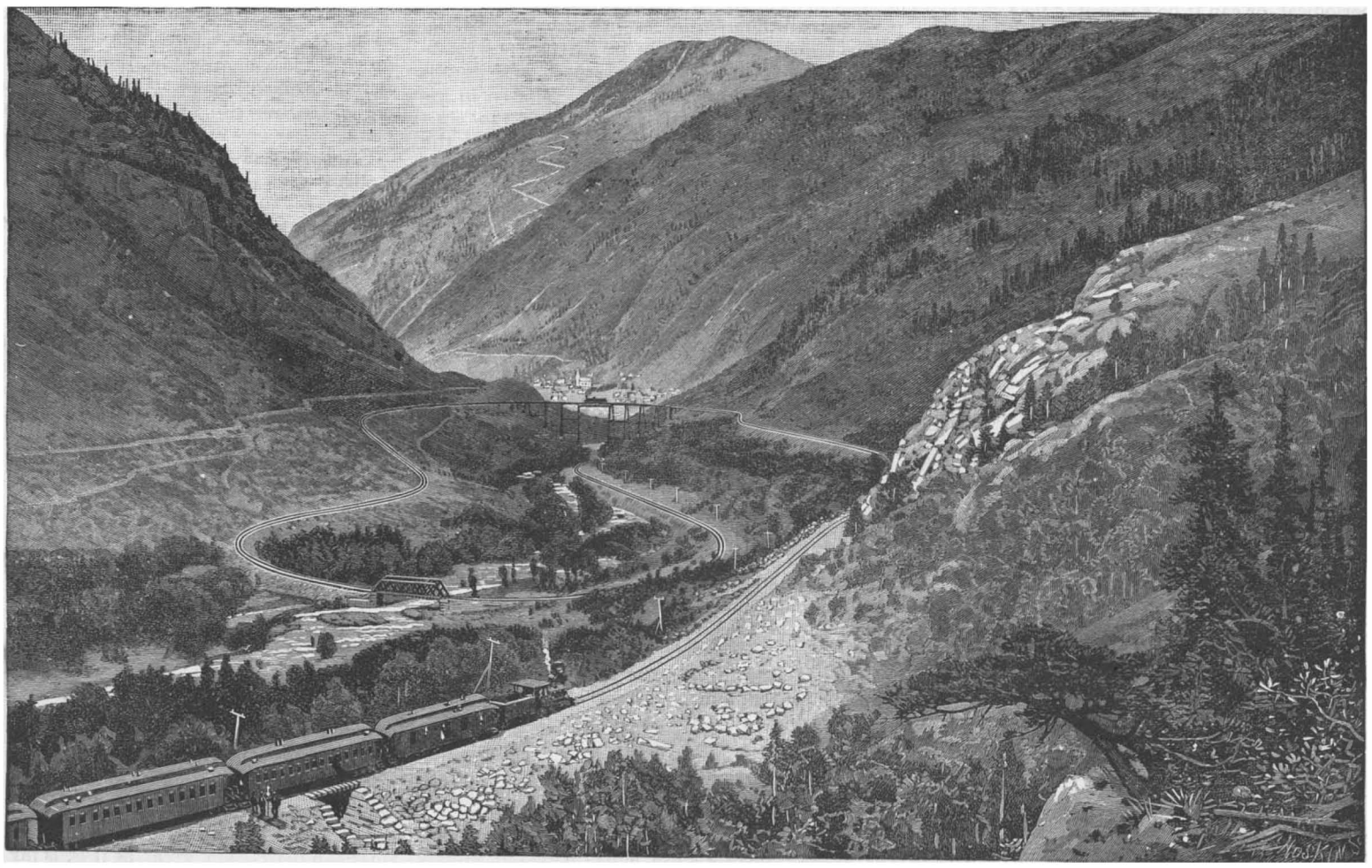


Fig. 3.—LOOP, GEORGETOWN BRANCH OF THE UNION PACIFIC RAILROAD, COLORADO.

© 1890 SCIENTIFIC AMERICAN, INC.

contraction is made. After the trusses were completed, the bottom chords were cut at points seventy-five feet distant from the piers, on the shore sides of the piers. Although no falsework appears in the illustration, temporary wooden supports were used when the cantilevers had reached half way out. These formed starting points for the remaining portions of the truss. In Fig. 6, page 154, is shown a loop and curved trestle upon the Colorado Midland Railroad. It is its own best commentary, affording an instance of boldness both of conception and and of execution.

Aluminous Glass.

It is well known that certain varieties of glass when exposed to the action of fire, even for a short time, become opaque and the surface roughened.

Certain products of Thuringia, on the contrary, enjoy a well merited reputation, because glass coming from the manufactories of that country supports without deterioration fusion, remelting, reblowing, etc. This property has been attributed to the introduction of a certain sand obtained from the neighborhood of the village of Martinsroda.

It is interesting to understand the chemical composition of this sand.

Schott has made the following analysis of the sand, and side by side are the results of an analysis of the glass made from it.

	Sand from Martinsroda.	Glass made with sand from Martinsroda.
Silica	91·38	67·74
Alumina	3·66	3·00
Oxide of iron	0·47	0·42
Lime	0 31	7·38
Magnesia	none	0·26
Oxide of manganese	traces	0·52
Potash	2·99	3·38
Arsenious acid	none	0·24
Soda	0·50	16·01
Total	99·31	98·95

The extremely constant proportion of alumina in both sand and glass is remarkable, and calls for attention

In order to arrive at the exact significance of the presence of this base, various experiments were undertaken with glass, some samples being made with pure silica, and others were used into the composition of which a little alumina had been introduced in quantity about equivalent to that contained in the sand of Martinsroda.

In submitting these different glasses thus prepared to the operation of remelting down into window glass, it was evident that it was much more easily effected in those samples which contained the alumina.

In short these experiments, which were very thorough, proved that the admixture of feldspar or alumina communicated to the glass greater strength, and made it more easy to work.

M. Schott attributes these advantages to the property which alumina possesses of lessening the volatilization of the alkalies in the superficial layers, and preventing that crystalline structure which always characterizes an easily broken glass, and which is due to the tendency of the double silicate of calcium and sodium to take the form of crystals.

The Prospering South.

Never in the history of the South has her future looked so bright as at present, and never has there been a year more generally prosperous than the one that has just closed. The cotton crop for last year is, in round numbers, about seven million three hundred thousand bales, of which the larger part is in the hands of the planter. Cotton has advanced one cent within the past two weeks, and is strong, with upward tendency. This advance represents something like twenty million dollars to the South. Coarse cotton fabrics, so largely manufactured in the South, are advancing in price. Pig iron is in active demand, and Southern furnaces are all in operation. The price of pig iron has lately advanced $1.25 per ton. Mineral and timber lands have greatly advanced in value, and sales are made almost daily. Yellow pine lumber is being more extensively used every year, and prices are improving. Many of the mills have advanced prices from one to two dollars per thousand feet for dimension stuff. The demand for all the Southern hard woods is brisk and prices are, generally speaking, higher. The farmers are almost entirely out of debt, prosperous, and happy. There are few mortgages on Southern farms. The Southern towns are developing at a marvelous rate—faster, perhaps, than ever known in any portion of this country. Small manufacturing establishments are springing up all over the South, and in most cases are exceedingly prosperous. In short, there is an increased activity in all branches of industry, and the next ten years will offer the greatest opportunities ever known for making money in the South.—*Southern Lumberman.*

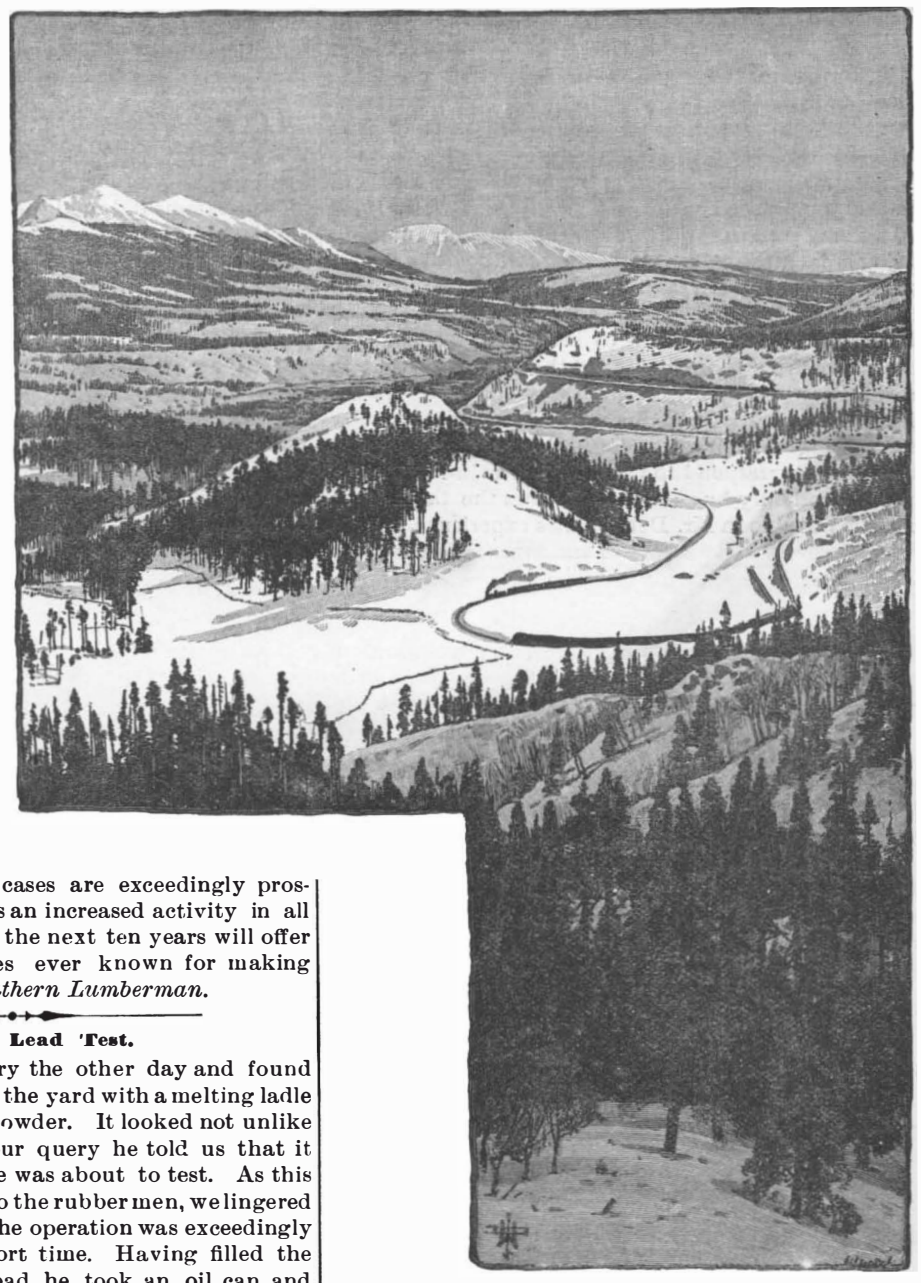


Fig. 4.—VIEW FROM ROCKY POINT, DENVER, COL., SOUTH PARK AND PACIFIC RAILROAD.

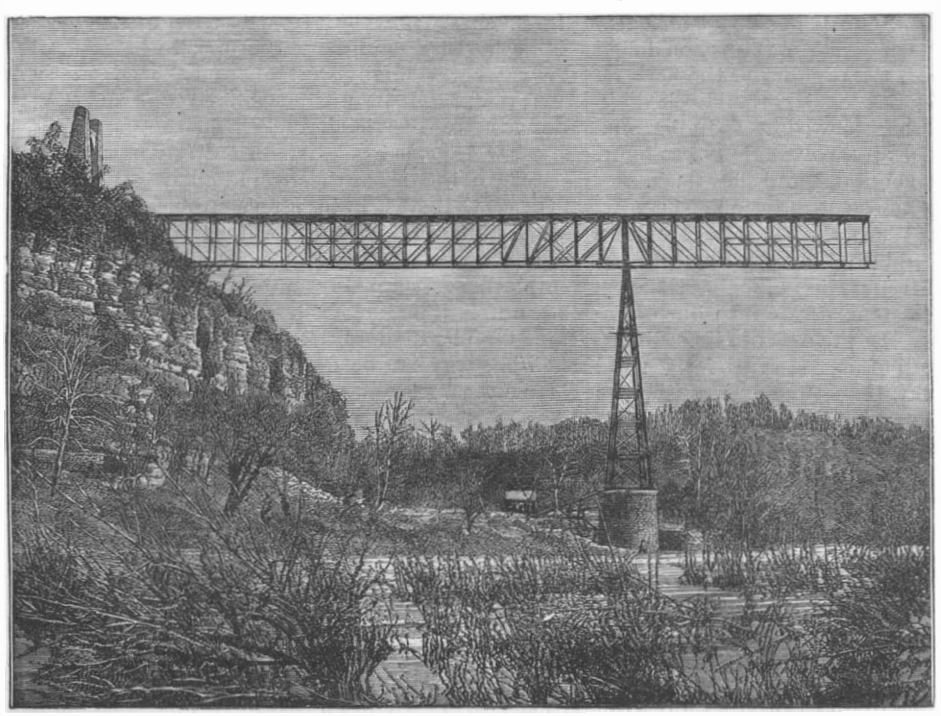


Fig. 5.—KENTUCKY RIVER BRIDGE ON THE CINCINNATI SOUTHERN R.R.

A White Lead Test.

We happened in a factory the other day and found the superintendent out in the yard with a melting ladle in his hand full of white powder. It looked not unlike whiting, but in reply to our query he told us that it was white lead, which he was about to test. As this test would be of interest to the rubber men, we lingered to see how it was done. The operation was exceedingly simple, and took but a short time. Having filled the ladle full of the white lead, he took an oil can and poured a little oil over the top of the mass, then placed the vessel in the fire and waited until the whole of its contents had fused. When he had run the powder down to pig lead again, he weighed it, and expressed his satisfaction at finding that he had exactly a pound, which had been the weight of the powder before it was melted.

His original method of detecting fraud in lead reminds us of another experiment we saw him make, with a view to learning the purity of whiting. He simply filled a cup half full of whiting, held it under a faucet, and stirring it with the finger allowed all that could to run off in the water as it overflowed the cup. In the bottom was left a certain percentage of what he called silver sand, which, in reality, consisted of particles of flint or bits of cliff stone that had not been ground fine. Where he had a whiting that formed a very large sediment of this kind he called it poor, and looked around for one that gave him less. As a simple test for goods of this sort it is very good.—*India Rubber World.*

M. NODON, having demonstrated that the solar rays shining on an insulated conductor communicate a positive electric charge thereto, may give a clew to many natural phenomena, as, for example, those depending on atmospheric electricity, and will probably bear fruit in enabling us to trace more clearly the correlation between light and electricity.—*Photo. Review.*

Gates on Passenger Cars.

A passenger was killed on the Boston & Maine a fortnight since by getting off a passenger train at a station on the "off side," and being struck by a slowly moving empty engine on the adjoining main track. The passenger alighted before the train stopped, and there was lack of judgment in signaling the empty engine, but the State Railroad Commissioners, who investigated the case, lay chief stress on the matter of gates. It appears that all the cars in the train were equipped with platform gates, and that the commissioners have in past years recommended the roads of the State to use such a safeguard, but they were not closed in this instance, and the superintendent testified that passengers objected to them and threatened to jump over if they were used. The commissioners very justly reiterate their recommendation, and apply it specifically to "all divisions of the Boston & Maine road." It is true that passengers will "kick," and that with the ordinary car platform it is not easy to make a perfect barrier, but a well designed gate, such as may be seen on the Boston & Albany and the New York & New England, is a valuable means of warning passengers that there are bounds beyond which they can go only at their peril. It is one of the wonders of modern civilization that so many hundreds of passenger trains daily discharge their passengers at stations where express trains pass by within 4 ft. of unprotected steps, and at speeds from 15 to 30 miles an hour or faster, without killing more passengers than they do. The American traveler who does not have his wits about him is a very infrequent fellow, comparatively, but he needs to be looked out for nevertheless.—*Railroad Gazette.*

Treatment of Tetanus.

The author has before made the statement that the best remedy for tetanus is absolute rest of the patient. He has already cured four out of five cases by this method. The tetanus patients were taken into a completely isolated, quiet, and darkened room and their ears stopped; the floor of the room was carpeted. All the manipulations were made when possible in the dark, only fluids were given as nutriment and absolute bodily rest was insisted upon. If they suffered from violent pains, belladonna and secale cornutum were given internally. He gives the complete history of a case of traumatic tetanus which recovered under this method of treatment.—*By E. De Renzi (Italy), Riv. Chir. e Terapeut., No.* 1, 1889; *Annals of Surgery.*

© 1890 SCIENTIFIC AMERICAN, INC.

Practical Experience as to Magnesium Lighting.

The discussion at a recent meeting of the Photographic Society of Great Britain was so rich in the elucidation of important points relating to magnesium lighting for photographic use, that special mention becomes desirable.

On a member handing round some flash-light groups which showed indications of that sort of flare or fogginess which rises from extraneous light entering the lens, Mr. W. E. Debenham gave it as his experience that, owing to the considerable extent of the flash-flame and the almost inevitable conditions of arrangement in flash-light work for groups, this sort of flare almost invariably degrades the results, unless very efficient arrangements are adopted for shading the lens. Indeed, he pointed out that in flash-light work there is, we may say, *in every case* an enormous advantage in fixing a long tunnel of blackened cardboard, or some other suitable material, in front of the camera, so that the lens looks at the scene through this tunnel; and another point of moment is to have four flaps or sliding pieces fitted to the mouth of the tunnel, so that in arranging the apparatus these flaps or sliding pieces can be set inward as much as possible without actually contracting that portion of the image on the screen which will correspond to the trimmed print. By such means—and only by such means—does the best result become possible in Mr. Debenham's experience.

Mr. Debenham did not give any details as to the construction of the fore-camera or shade he prefers to use, but from our own experience in analogous cases we recommend a square collapsible tube, formed by gluing four pieces of cardboard on to a piece of velvet; the size of this tube being such that it slips over the front of the camera and is thus rendered rigid for use. The "pile" or fiber ends of the velvet should point outward, so that reflection is reduced to a minimum, and as the area of the shade tunnel will be full that of the camera, it may, without risk of contracting the field of view, be made a little or sometimes considerably longer than the focusing length of the camera for the lens to be used. The four flaps for finally contracting the area through which the light reaches the lens may very well be made of two thicknesses of black calico cemented together by thin glue, an arrangement which makes it easy to fix them to the required aperture by means of four ordinary pins.

Such a shade as we have described folds flat like a portfolio, and is a useful addition to the outfit of even the outdoor photographer; especially when he works with the camera directed toward the light-giving side of the heavens—a thing common now, but forbidden by the old school of photographic conventionalists. Such modifications in the shade as may be necessary for allowing any required shutter fittings to pass are easily arranged, although when the shade is used for ordinary flash-light work, no shutter is required.

Mr. Friese Greene now said that from a business point of view he had found flash-light portraits tend to be a failure. The pupil expands in the weak light preceding the exposure, and even when the flash is so rapid as to show no indication of a closing up of the eyelid, the eyes never have quite a natural expression; they have rather the expression of the face as it exists in partial darkness, and as it is not seen.

A remedy for this state of things is not hopeless, as several persons in the room pointed out. The apartment must be illuminated with bright gaslight or other artificial light, which light must *not be subdued just before the flash*, and means must be found to make the flash more instantaneous than it is with the ordinary blow-through lamps. At the same time it is to be noted that the shutter of the dark slide must, under the circumstances, only be drawn just before the flash, and it must be closed immediately afterward.

As regards the means of quickening the flash, Mr. Warnerke insisted on the desirability of using only a small quantity of magnesium dust in each lamp, so as to insure immediate and complete combustion, and during the present season it is often absolutely needful to dry the magnesium dust before use. Mr. Warnerke was opposed to the use of pyrotechnic mixtures containing magnesium, not only on account of their danger, but also on account of their uncertainty in action; and a subsequent remark by Mr. Chapman Jones gave a clew to what has long been recognized, namely, that the pyrotechnic mixtures are so variable in the rate at which they burn as to be undesirable for every-day use, apart from any question of danger. He described the following experiment:

Two grains of magnesium dust were carefully dried, and a similar quantity of finely powdered potassium chlorate was also dried, the two being now *cautiously* mixed while slightly warm. This mixture, on being fired, positively detonated, the rapidity of the flash recalling the discharge of a Leyden jar, the shock shaking the windows of the laboratory; but a similar mixture, if only exposed to the air for a fraction of an hour, burned with a comparatively tame and slow flash.

The discussion passing on to the question of burning magnesium ribbon, Mr. Warnerke exhibited and explained the lamp made and sold by Mr. Ney, of Berlin, which lamp has the reputation of being the only ribbon lamp which can be depended on to burn steadily for an hour or more. In the case of the ordinary clockwork lamp a long tail of magnesia ash forms; and this first weakens the light, then often extinguishes it; but in Ney's lamp a striker crosses the ash at intervals of about two seconds, knocking it off, so that it is received by a pair of breaking-up rollers. In the Ney lamp an ounce of ribbon, having a length of between fifty and sixty yards, will burn for about an hour and a half, and, at the present low price of magnesium, the light is so cheap and convenient that Mr. Warnerke said it was folly to use any other light for copying, especially at this season. It has all the advantages of sunlight, with the additional one of being so constant that the exact exposure can be determined beforehand, after a little practice. In copying a print or a picture it is convenient to hold the lamp in the hand first on one side and then on the other, moving it meanwhile sometimes in a vertical line and sometimes in a horizontal line, so that creases or texture shall not become apparent. Except in very rare cases, less than half a minute is sufficient for the exposure, unless a yellow glass is placed in front of the lamp, a course which Mr. Warnerke much prefers to using a yellow screen in conjunction with the lens, and so risking the fineness of the definition.

An excellent point of the new lamp is that the *whole of the fumes* pass up the chimney, and this chimney is quite small—about an inch in diameter. Mr. Warnerke showed how easy it is to roll up a newspaper so as to make an extension of the chimney of several feet in a horizontal direction toward fireplace or window; or for temporary use it may be led into a large box, which acts as a settling chamber.

Now that magnesium is cheap, and we can have an hour's lighting at a cost of something like one shilling, its use will undoubtedly extend.—*Photo. Review.*

Natural Gas Freaks in Indiana.

A Kokomo (Ind.) note says:

A singular misfortune has overtaken the family of William Shenk, a farmer living five miles east of this place, in consequence of the finding of natural gas. About two months ago the Diamond Plate Glass Company leased Shenk's farm for gas and put down a well. On reaching a depth of about 800 feet a big flow of the elastic fluid was secured, which shot out the tools with tremendous force, followed by a stream of water that reached the height of at least 125 feet, and continued without cessation for more than a week, despite all efforts by the owners of the well to get it stopped. Shenk's farm was flooded so that he was compelled to dig trenches to prevent it from destroying his wheat crop and otherwise doing great injury to his land. But the water was finally shut off, and the gas and water separated, and it was considered one of the best producers in this vicinity. Within the past few days, however, the gas has taken an entirely new freak, and is now coming out of the ground all over the farm, and it is easy to light it in hundreds of places by simply applying a match. Even the water in the farmer's drive well is forced out by the gas, and the family is contemplating a removal from its residence to avoid being blown up. Shenk considers that his farm is entirely ruined, and will doubtless abandon it altogether, unless some way can be devised to control the escaping element.

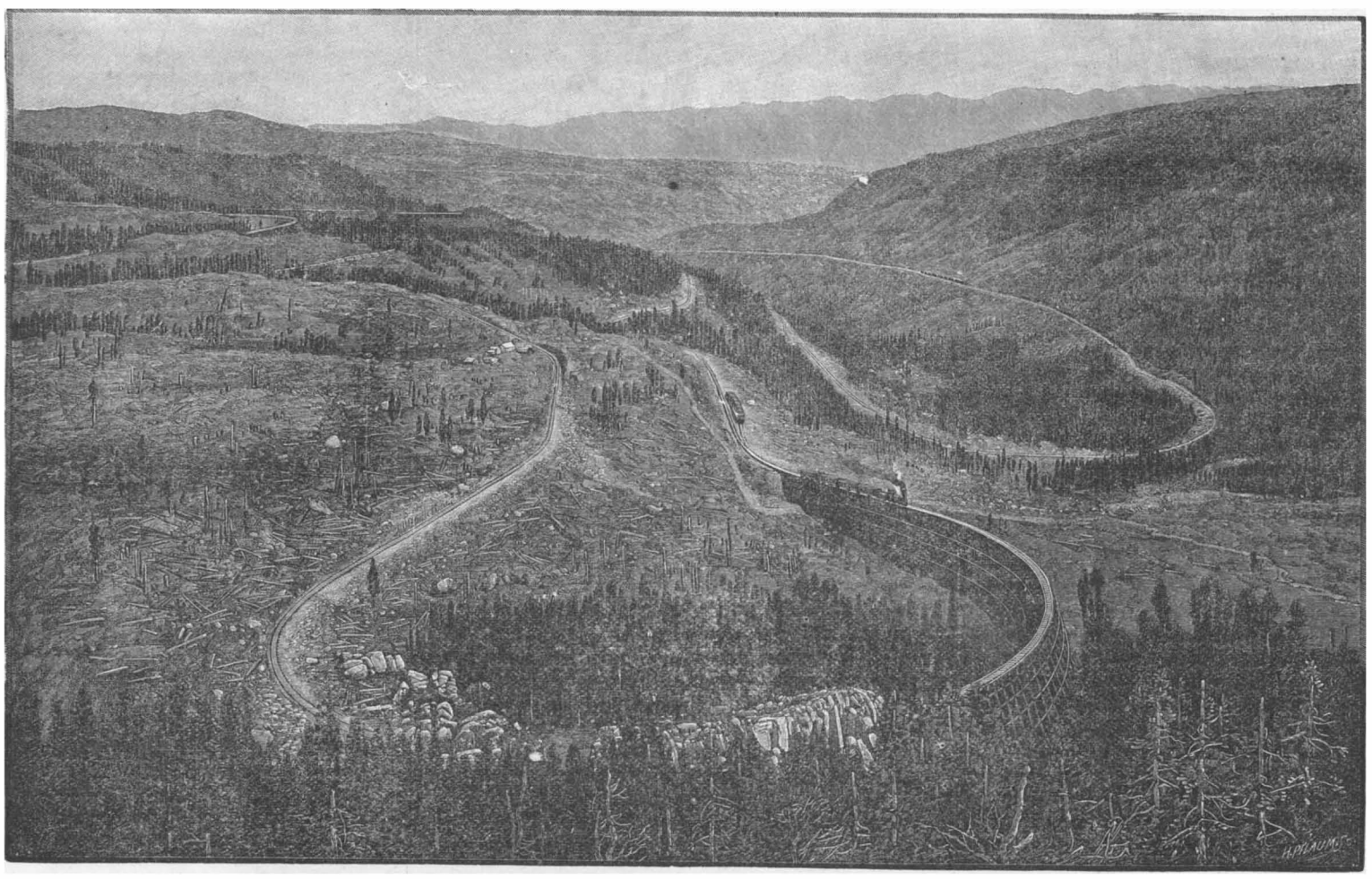


FIG. 6.—LOOP AND GREAT TRESTLE NEAR HAGEMAN'S, ON THE COLORADO MIDLAND RAILROAD.

A Privilege of Old Age.

A wise old man, the late Dr. James Walker, president of Harvard University, said that the great privilege of old age was the "getting rid of responsibilities." These hard-working veterans will not let one get rid of them until he drops in his harness, and so gets rid of them and his life together. How often has many a tired old man envied the superannuated family cat, stretched upon the rug before the fire, letting the genial warmth tranquilly diffuse itself through all her internal arrangements! No more watching for mice in dark, damp cellars, no more watching the savage gray rat at the mouth of his den, no more scurrying up trees and lampposts to avoid the neighbor's cur, who wishes to make her acquaintance. It is very grand to "die in harness," but it is very pleasant to have the tight straps unbuckled and the heavy collar lifted from the neck and shoulders.—*Dr. Holmes, in the Atlantic.*

© 1890 SCIENTIFIC AMERICAN, INC.

THE SCIENTIFIC USE OF THE PHONOGRAPH.

BY GEO. M. HOPKINS.

I.—THE CHARACTER OF THE PHONOGRAPHIC RECORD INTERPRETED BY VIBRATING FLAMES.

The phonograph in its perfected state, although a scientific triumph and a model of mechanical and electrical skill, is designed for commercial and social purposes rather than purely scientific use. Still it has within itself all the elements necessary for several very interesting physical experiments. These are obviously related to sound or vibratory action, some of them being illustrative of the phenomena of the phonograph itself.

Mr. Edison in the multitude of his cares finds no time to develop the purely scientific applications of this most interesting invention. He has, therefore, delegated this pleasant task to the writer, who has given the subject considerable attention, and has devised a series of phonographic experiments, one of which is shown in the annexed engravings. This is given first, as it seems best calculated to illustrate and explain the action of the phonograph.

The instrument shown contains all the recent improvements. The phonographic record is made on a hollow cylinder of wax-like material. This cylinder is fitted to a cone mounted on the screw shaft. This shaft turns on two pointed bearings, one of which is fixed, the other being supported by a swinging arm, seen at the right hand end of the machine in the engraving. This construction permits of placing the record cylinders on the cone and removing them quickly and without the necessity of making any adjustments. The screw shaft is provided with a loose central bearing, which holds it up when the end bearing is swung around.

On a fixed rod arranged parallel with and behind the screw shaft is placed a sleeve which carries at one end a spring arm provided with a segment of a nut, which rests upon the threaded portion of the screw shaft. To the other end of the sleeve is attached a curved arm, which reaches over the record cylinder and supports the diaphragm cell. The latter is fitted to a socket in the arm, and is arranged so that it can be turned in its own plane through a few degrees to bring the recording and reproducing styluses into the position of use. An arm projecting from one side of the diaphragm cell is used to effect this change of position, and an adjusting screw, located above the arm, is used for securing a fine adjustment of the reproducing stylus. The enlarged sectional view, Fig. 2, shows the diaphragm cell and parts connected therewith, actual size.

The diaphragm is a glass disk about 1-200 inch in thickness. This is clamped at the edge between two thin soft rubber rings. To the center of the diaphragm is connected a stud, to which is pivoted one end of the lever, *a*. The opposite end of the lever is forked. One arm of the fork carries the reproducing stylus, *b*, and the other carries the recording stylus, *c*. These styluses are made of sapphire, a material which ranks next to the diamond in the scale of hardness. The reproducing stylus is a microscopic sphere or knob, perfectly smooth and highly polished. The recording stylus is cup-shaped upon the end which cuts the record cylinder, and is provided with a very keen edge.

The lever, *a*, is pivoted at or near its center in a stud projecting from the weighted lever, *d*, which is delicately hinged to the upper part of the diaphragm cell, its lower end being free to move within certain limits. This construction permits the recording and reproducing styluses to follow the surface of the cylinder whether it is perfectly true or not. It also allows the recording and reproducing apparatus to adapt itself automatically to cylinders of different diameter.

It will be seen that the lever, *a*, is one of the first order, with a movable fulcrum, and that whenever the free end of the lever is moved upward by the projections of the record cylinder, it tends to lift the weighted lever, *d*; but owing to the inertia of this weighted lever it is unable to follow all the movements of the lever, *a*. As a consequence the motions of the latter in the reproduction of speech are imparted to the diaphragm. In making a record, the reverse of this occurs, *i. e.*, the rapid motions of the diaphragm are imparted to the reproducing stylus, which cuts in the record cylinder a groove with depressions and elevations, which taken together correspond in form to the sinusoidal curve which would represent the sound waves by which the vibratory movements of the recording mechanism were produced.

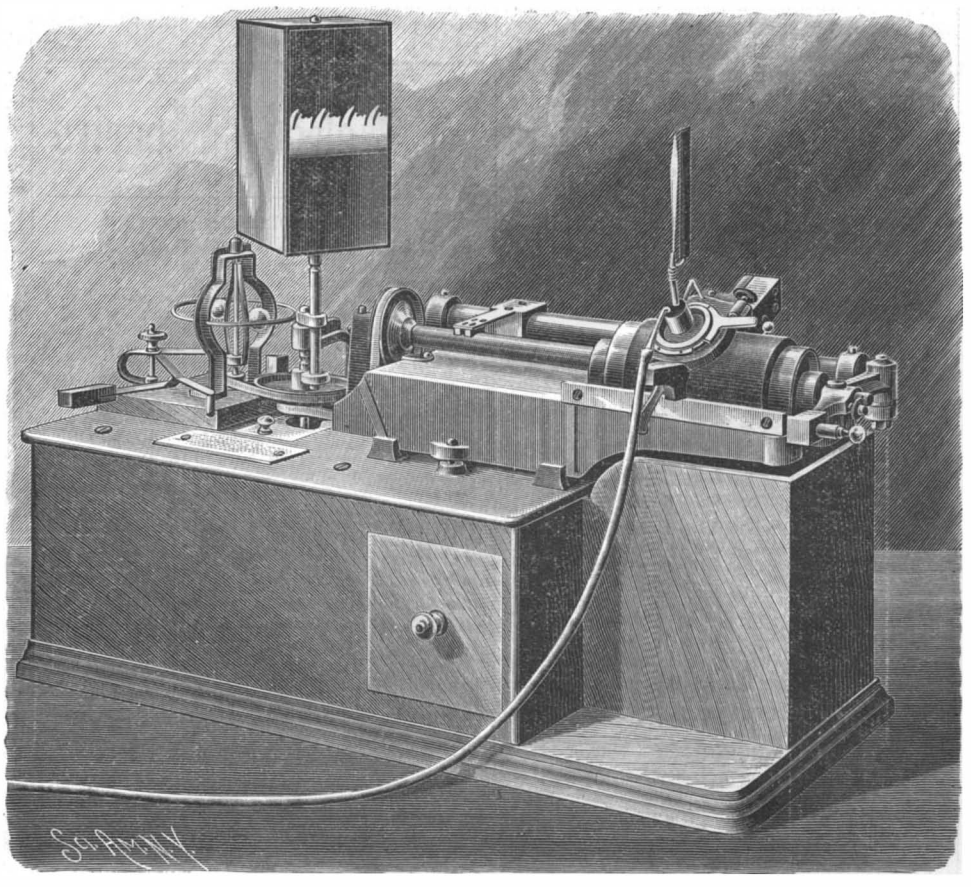


Fig. 1.—PHONOGRAPH—LATEST FORM, WITH VIBRATING FLAME ATTACHMENT.

The arm carrying the diaphragm cell also supports an adjustable turning tool of sapphire, which is arranged to turn off the cylinder simultaneously with the production of the record. This tool is arranged to automatically disengage itself from the cylinder when the reproducing apparatus is thrown in place.

The phonograph cylinder is rotated by a very perfect electric motor, regulated by a sensitive governor. To the perfect regularity of the motion of this motor much of the success of the phonograph is due, especially in the reproduction of music, where the slightest accel-

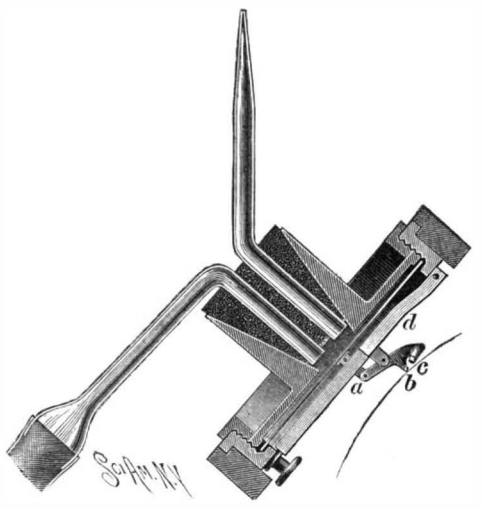


Fig. 2.—SECTION OF THE DIAPHRAGM CELL.

eration or retardation would reveal itself in changes of both pitch and time.

By applying to the phonograph two very simple attachments, the vibrating flames of Koenig may be produced by the movements of the diaphragm, so that the character of the phonographic record may be readily understood. One of these attachments consists of two glass tubes inserted in a perforated cork, one of the tubes terminating in a slender nozzle, the other being connected with a gas supply by a flexible rubber tube. The perforated cork is inserted in the opening of the mouthpiece, so that gas may flow into the diaphragm cell, and out through the small nozzle, at the point of which it is ignited, forming a long narrow flame. In front of the nozzle is arranged a screen of sufficient height and width to hide the flame.

The other attachment consists of a prism carrying on each of its four sides a plane mirror and mounted on a spindle having upon its lower end a friction wheel, which is revolved by contact with the boss of the pulley on the main shaft of the electric motor. The spindle of the mirror is journaled in a sleeve supported by an arm connected with the pointed rod forming the upper bearing of the motor shaft.

Arranged in this manner the mirror revolves whenever the phonograph is operated. So long as the diaphragm of the phonograph remains quiescent the slender flame is undisturbed, and the revolving mirror reflects only a plain band of light; but when the diaphragm is vibrated by the contact of the reproducing stylus with the face of the record cylinder, every projection of the record pushes the diaphragm outwardly, thus forcing the gas outward, accelerating its flow through the nozzle, thereby elongating the flame, while every depression of the record allows the diaphragm to move inward by its own elasticity, thus drawing the gas inwardly, effecting a retardation of the flow of gas through the nozzle, thus causing a sinking of the flame. These changes in the length of the flame take place with such rapidity that no change in the character of the flame is observable with the unaided eye, unless the eyes are quickly turned from side to side, when the vibratory nature of the flame will appear; but no satisfactory analysis of the flames can be made in this way. They must be viewed in the revolving mirror to determine their true form and the relation of the crests and hollows of the flame waves. These flames represent, in a greatly exaggerated form, the shape of the projections and depressions of the phonographic record. Every vowel produces a characteristic series of waves or flames, the images of which are spread out by reflection from the revolving mirror. Musical sounds from different instruments yield flames differing from those formed by vocal sounds. A song produces a rapid succession of flame images, which constantly vary in form and size.

As an aid to the understanding of the phonographic record and the action of the phonograph, nothing can excel this simple device.

The Wonders of Gas Wells.

The Pittsburg *Dispatch* of January 25 says:

Passengers over the Pittsburg and Western Railroad have noticed near De Haven Station, for two nights past, a huge shaft of fire standing up against the sky and illuminating many square miles of territory with its lurid glow. Wonder as to what caused this remarkable flame phenomenon has been liberally expressed. It is the Spang, Chalfant & Co.'s well No. 2, which is on fire, and which has burned furiously since last Thursday morning, resisting all efforts to check it. A probable fatality is an unpleasant feature of the burning well.

The well came in last Wednesday with a rush. It showed a pressure of about 500 pounds, being equal in value to the No. 1, which came in several weeks since. Both wells are on the Steiner farm, distant nearly two miles from De Haven Station.

The well was permitted to blow off all Wednesday night, and Thursday four drillers set to work to plug the well with the customary appliances. They were working right at the hole in the ground, with the gas rushing forth at high pressure, when, in some mysterious manner, the well caught fire. How, the men are utterly unable to say.

The surging flames swept skyward with a furious roar, enveloping all four drillers in a mass of flame. . . . A force of men was at work yesterday trying to extinguish the burning well, but without success. The column of flame is nearly 100 feet in height, and presents a grand spectacle; but the heat is so intense that the men found it impossible to get near enough to accomplish anything. It is believed that the famous process of smoke-stacking, which was employed so successfully at the great Murrysville gas well fire, will have to be made use of before the well is put out. A smokestack of sufficient size will probably be made to-day by Spang, Chalfant & Co., and taken to the place for use.

Expert Court for Patent Cases.

Those who are present at the hearing of a great patent suit in a United States court cannot but be struck by the incongruity and essential injustice of submitting vast business interests dependent upon mechanical appliances to arbitration of a judge who may have no more appreciation of machinery or mechanical ideas than he has of the foliage of the planet Jupiter. Only a few judges on the bench are really competent to try a patent case, except, of course, so far as the law points are concerned. When the matter hinges upon the novelties of this or that device, and the infringement of one device upon another, very few of the judges are qualified by nature and training to hear the case and decide intelligently upon its merits. This emphasizes the necessity of a special court for the adjudication of patent claims, the judges of which should be drawn from the highest class of patent attorneys, commissioners of patents, and those who may fairly be called experts in mechanics. At the very least, the *American Miller* thinks, one or more experts should sit with the judges of the United States courts to decide mechanical questions, leaving to the judges the decision of law points.

© 1890 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM BOILER FURNACE. — Micheal E. Herbert, St. Joseph, Mo. This boiler has water legs upon each side, combined with fuel magazines at its front end communicating with the fire box under the water legs, and feed devices at the bottoms of the magazines to feed the fuel to the grate, while the gaseous products are separately carried off and consumed.

Railway Appliances.

CAR COUPLING.—Adoniram J. Chapel, Arkansas City, Kansas. This is an improvement in that class of devices known as twin jaw couplings, the front section of the hook being provided with a link mortise, in connection with a transversely movable shoulder section, an arm or bar extends from which over the front section, and the coupling pin being movably supported on this arm or bar.

CAR COUPLING. — Solomon Heymann and Berry Prosser, Fayetteville, Tenn. In this device the pin is attached to a lever pivoted beneath the drawhead, the pin working up and down from the bottom of the drawhead, the pushing back of a sliding bar in the drawhead by an entering link operating the lever through a rack of teeth to push the coupling pin up through the link.

WEAR PLATE FOR TIES.—Thomas A. Davies, New York City. This is a rectangular plate with an integral continuous marginal flange, being designed to protect the surface of the tie covered thereby from the action of water, and to prevent the ingress of water between the plate and the tie.

BULKHEAD FOR TRACKS. — Thomas A. Davies, New York City. This invention provides for the planting of opposed beams at suitable distances apart in a length of track, with which the track rails are connected by a strap plate and loop, making an anchor for the rails, so that the entire line of rails will be effectually prevented from creeping.

Mechanical.

PIPE WRENCH. — Thomas W. Fisher, Helena, Mont. A stationary jaw is on the forward end of a shank having a sliding rack, a handle being pivoted to the shank and rack, while a recessed movable jaw is fitted to slide on the shank, there being a pivoted and toothed catch in the recess of the movable jaw, with a thumbpiece, and a spring for pressing the catch into engagement with the rack.

GLASS POLISHING WHEEL. — Wyman Kimble, Honesdale, Pa. This invention consists of a wooden wheel composed of sector sections, each so cut and connected to the adjacent sections that the grain of the wood of each section will run at about right angles to the forward radial edge of the section, the sections being united by dovetail joints.

ROLLER GRINDING MILL. — Henry Bowman, St. Joseph, Mo. This invention provides improved means for regulating or adjusting the rolls of roller grinding mills with reference to each other, so as to render them parallel, and also spring-seated or yielding to obstructions which may pass between them.

Agricultural.

PLOW. — Stanly Tanner, Cheneyville, La. This is a plow more especially adapted for breaking out the middle ground between rows of plants, the implement carrying a right and left plow and a sweep or double mould-board, which will follow the plows, aligning the center of the intervening space.

Miscellaneous.

FEED CUTTER. — John B. Sykes and Thaddeus A. Faust, Dawson, Pa. This is a strong and simply constructed machine in which the cutting blade is driven directly from the main shaft, and provides means for firmly clamping the material to be cut close to the knife as the latter is descending, and a feed mechanism which will carry the material forward to the knife at the proper moment.

COTTON OR HAY PRESS ATTACHMENT. —William W. Adams, Ozark, Ark. This is a tramping apparatus attached to or over the press for packing the material preparatory to pressing it, and is adapted for use on all presses in which the head block leaves the press box completely open, obviating the necessity of doing this work by muscular power.

HAND TRUCK.—Joseph Annin, Brooklyn, N. Y. This truck has an improved joint connection between the side and cross bars of the frame, and an improved form of such bars, giving great strength and rigidity with minimum weight of parts, being designed for heavy work in warehouses, foundries, machine shops, etc.

PEDESTAL FOR VEHICLES. — Thomas Hill, Jersey City, N. J. This invention covers a variety of constructions for pedestals for the support of carts or other vehicles, up to an adaptation for use with railway passenger or freight cars, the invention covering novel arrangements and combinations of elements.

STIRRING MACHINE. — Reinhold Handel, Leipsic, Saxony, Germany. This is an adjustable device whereby powder, dough, thick liquids, and similar materials may be thoroughly commingled and mixed in any suitable receptacle, operating stirrers in different planes within the receptacle, and removing any of the liquid or plastic compound which may be deposited upon the upper edge of the receptacle by the stirring operation.

BRACELET. — William Riker, Newark, N. J. This invention relates to that class of bracelets known as "bangles," and consists in a peculiar fastening for securing the ends of the ring to each other, to enable the ring to be readily adjusted as to size.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY IN MODERN LIFE. By G. W. De Tunzelmann. London: Walter Scott. Pp. viii, 272.

The present volume contains the usual contents of such works, of which a great many have been published recently. It gives a general history of electricity and its development in recent days. It is illustrated by a number of cuts taken, generally, from the *Electrician* and *Engineer*. As a *resume* of the science it is compact and of interest.

THE COSMIC LAW OF THERMAL REPULSION. New York: John Wiley & Sons. 1889. Pp. 60. Price 75 cents.

Heliofugal power is invoked by the author of the present work—whose name is nowhere discernible—to account for the phenomena of the motions of comets. The author, in a brief preface, states that the essay embodies ideas, the development of which afforded him much pleasant recreation, and it is to be hoped that the readers will obtain the same therefrom.

PRACTICAL MARINE SURVEYING. By Harry Phelps. New York: John Wiley & Sons. 1889. Pp. vi, 217. Price $2.50.

A somewhat neglected field of surveying is excellently treated of by the author. The most complicated methods are thoroughly described. Soundings, shore survey, sounding with wire, determination of heights, tidal and magnetic observations, and other classes of surveying are all included. Enough is said to indicate the character of the book when it is noted that its subject is thoroughly covered in all its aspects, and that the consideration of the different topics is given with sufficient clearness to make it thoroughly readable and not simply a dry collection of mathematical formulæ. A number of plates are used to illustrate the construction of instruments and the triangulation of different kinds of territory.

Scribner's Magazine for March is an excellent number and contains an interesting article on Charles Lamb, with several good portraits of that celebrity. "A Forgotten Remnant" is an account of the Seminoles of Florida, part of the tribe having remained in that State when the Seminoles migrated to the West. There is an able article on John Ericsson by William C. Church. Besides these there is an article on the Boomerang and several serial stories.

Received.

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY. Parts 1, 2, 3, and 4, 1889.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY NUMBER.—(No. 52.)

TABLE OF CONTENTS.

1. Elegant plate in colors of a cottage on Staten Island, N. Y., from drawings and specifications supplied by Munn & Co. Perspective elevation, floor plans, and details.
2. Plate in colors of a residence at Buffalo, N. Y. Floor plans, sheet of elevations, details, etc.
3. An ornamental carriage house at South Orange, N. J. Perspective elevation.
4. Engravings of the new auditorium building, Chicago, Ill.
5. A Staten Island cottage, costing $3,300 complete. Floor plans and perspective elevation.
6. A residence at Portchester, N. Y. Cost $11,500. Lamb & Rich, New York, architects. Plans and perspective elevation.
7. A dwelling at Hill View, Dunwoodie, N. Y. Cost $5,100 complete. Floor plans and perspective elevation. Architect, C. E. Miller, New York.
8. Design for a cottage at Mystic, Conn., by F. W. Beall, architect, New York. Elevations and floor plans.
9. A double dwelling house at Stamford, Conn., erected at a cost of $7,800 complete. Plans and perspective.
10. Cottage erected at Larchmont Manor, N. Y. Cost $4,350. Floor plans and perspective.
11. The new Carteret club building erected at Jersey City Heights, N. J., from designs by Bradford L. Gilbert, of New York. Cost $90,000.
12. The Oriel Row of thirteen houses, San Francisco, Cal. Erected at a cost of $5,800 each. Plans and perspective.
13. A recently erected cottage in "Iselin's Park," New Rochelle, N. Y. Cost $6,000. Perspective and floor plans.
14. A very pretty cottage at Hill View, Dunwoodie, N. Y., recently completed at a cost of $5,000. Chas. E. Miller, architect, New York. Floor plans and perspective elevation.
15. Miscellaneous Contents: Baths in school houses.—Combined wood worker and moulder, illustrated. —The Gurney Hot Water Heater Co.—A practical device for working window shutters, illustrated.—Square turned work for balusters, columns, etc.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For steel castings of best quality, write the Buffalo Steel Foundry, Buffalo, N. Y.

For Sale—W. A. Brice's patent in U. S. or England for camera illustrated on page 148. Address patentee.

Wanted--A party who can construct the apparatus to vulcanize sheet rubber in small pieces by vapor and can teach the process. Please address Manufacturer, care of Scientific American, New York City.

Hand ice making machine for domestic use.—The United States patent for sale of the only successful machine. Many hundreds in use in Great Britain and the colonies. A large and lucrative business certain. Address G. R. F., care of the International News Company, Bream's Building, Chancery Lane, London, England.

Wanted—An instrument maker thoroughly competent to adjust transits and levels. Address Jas. W. Queen & Co., Philadelphia, Pa.

Wanted—An energetic man, with some means, as partner in an established business for manufacturing call bells, sash locks, and other light metal patented novelties. Articles covered by several patents. Address J. P. Connell, Kensington, Conn.

For Sale—On royalty or entire interest in patent collapsible hat shade. See engraving, page 116, Vol. 62. Address S. B. Bartine, Pleasant Plains, N. Y.

Machine tools, catalogue No. 47-B; wood-working machinery, catalogue No. 52-A; steam power, catalogue No. 48. Largest lines offered by any firm in this country. Send for bed-rock prices, stating exactly what you want. S. C. Forsaith Mach. Co., Manchester, N. H.

Best Ice and Refrigerating Machines made by David Boyle, Chicago, Ill. 140 machines in satisfactory use.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., Chicago, Ill.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Tuerk water motors at 12 Cortlandt St., New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Wanted—By St. Louis house an A No. 1 foundry foreman. He must be thoroughly familiar with all the details of foundry work and capable of filling the position to entire satisfaction. State experience, age, salary wanted and reference. Address Foundry Foreman, care Scientific American, New York.

Iron, Steel, Copper, and Bronze Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. The D. Frisbie Co., N.Y. city.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 173.

Acme engine, 1 to 5 H. P. See adv. next issue.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1913) A. B. P. asks for a recipe for making paste shoe blacking. A. Blacking recipes are many. Several have been given in these columns. We give two formulas:

1.

Molasses	1 lb.
Ivory black	1¼ "
Sweet oil	2 oz.

Vinegar a little, after above have been mixed.

2.

Molasses	1 lb.
Ivory black	2 "
Oil of vitriol	¼ "
Sweet oil	¼ "
Water	q. s.

(1914) H. E. McC. asks: 1. How to construct an Æolian harp. I have a description of one in which a box is strung with violin strings, but do not understand construction. A. An Æolian harp may be made by simply stretching strings or wires across a sounding board. In our SUPPLEMENT, No. 483, one is described. 2. What composition is applied to produce mirrors, and how applied? A. Mercury and tin generally. We have recently described the process. See query, No. 1824. 3. What wages do marine engineers receive? A. From $50 a month up to $200 or more. 4. What is expected of dynamic and mechanical engineers? A. It depends on how high he stands in the profession. No exact basis can be given.

(1915) O. M. asks: 1. The chemical reactions which occur in a chloride of silver battery cell? A. (*a*) $Zn+2NH_4Cl+AgCl=ZnCl_2+2NH_3+2H+2AgCl$. The last three at once react by this reaction: (*b*) $NH_3+H+AgCl=NH_4Cl+Ag$; so that the ammonium chloride acts as a carrier of chlorine from AgCl to Zn. 2. Also in a Leclanche cell? A. $Zn+2NH_4Cl+2MnO_2=ZnCl_2+2NH_3+H_2O+Mn_2O_3$.

(1916) W. V. L. writes: 1. I lately made soap. It washes well, cleans well, but gives little or no froth. I used pure fat, 5 lb.; lye, ½ lb.; water, 2 pints. Probably I should have used soda, but did not because I wished to make a toilet soap. A. Remelt your soap, first cutting it up finely, adding some water, and pour off the soap from the lye if any forms. You seem to have too much fat. This may prevent its frothing, but home made soaps are apt not to froth much. 2. Please tell me of some perfume I could use to perfume the soap? A. Use 4 parts oil of rose geranium, mixed with 1 part each oil of rose and oil of cinnamon and 2 parts oil of bergamot. Any number of formulas can be given. 3. What to use to color the soap? A. Color with vermilion, carmine or an aniline color. It is best without any coloring.

(1917) F. W. K. writes: I am building the 8 light dynamo described in the SUPPLEMENT, No. 600, and have one nearly finished, except winding field and armature. 1. Now can I use office wire for winding magnets? A. Office wire will not answer. The insulation takes up too much space. Use magnet wire. 2. Can I wind magnets round and round, just as thread is wound on a spool, and give good results for incandescent lighting? A. Yes. 3. Should they be wound any different for an arc light? A. The machine will run an arc light when wound as directed in the SUPPLEMENT referred to. 4. Can I get more than one arc light from the dynamo? A. It depends upon the size. You could run two small arc lamps. 5. About how fast should I run it to get twelve 70 volt lamps on a circuit? A. About 3,000 revolutions per minute. 6. Is there any danger of burning armature out? A. It is not liable to burn out. 7. Will bronze do as well as copper for commutator? A. Copper is the best, but bronze answers very well and may be more easily worked.

(1918) Reader asks for a receipt for removing ink without soiling the paper. A. Apply 10 per cent solution of oxalic acid carefully with a fine brush; afterward blot it off and wash with water and blot in the same way. The paper will be somewhat affected probably.

(1919) G. B. H. asks a formula (1) for covering cracks and seams of rubber boots? A. Use a solution of gutta percha in bisulphide of carbon. 2. Also a formula by which I can make rubber-like cups. A. For manufacture of India rubber we refer you to our SUPPLEMENT, Nos. 249, 251, 252.

(1920) A. D. P. asks: 1. Can you inform me of a simple and accurate method of testing kerosene oil? A. To insure accuracy some skill in manipulation is required. The oil is heated on a water bath, a thermometer bulb being immersed in it, and from time to time a minute gas flame is quickly swept over its surface. The temperature is noted at which a slight flash occurs. It should not flash below 110° to 120° F. 2. What paper describes the method of manufacturing ice, and the machines for that purpose? A. We have published several articles on this subject in our SUPPLEMENT. We may refer to Nos. 85, 91, 358, and others.

(1921) P. N. asks: Will you kindly advise us as to what is the best non-conductor of heat and cold and yet cheap? We desire a packing to pack around water tanks to prevent water freezing in winter, and also to shed the heat of the sun in summer. A. Of materials for packing around tanks to prevent freezing and also keeping out the summer heat, that are not perishable, mineral wool, asbestos, and pulverized charcoal are the best in the order named. Pulverized corn cobs, saw dust, and prairie hay are good, but liable to become wet and rot from any leakage from the tank. In using any of the above materials, a tight matched board casing should be placed around the tank with 6 inches clearance, with the insulating material packed in lightly.

(1922) A. and B. ask: In a nest of boilers (high pressure) all connected by steam and water, and with 60 pounds pressure of steam, all heated by separate furnaces, if the fire under any one of them should get low, is it possible for a vacuum to form in the boiler with the low fire? A. When boilers are properly set in batteries, there should always be a check valve and feed regulating valve between the main feed pipe and each boiler. When this arrangement is used, and the valves for regulating the feed of each boiler manipulated by the fireman according to the firing of each boiler, the water level will always be under control. Boilers set with free feed water inlets from a common main are constantly changing the water level to suit the steaming capacity of each of the fires. The surging of the water level is caused mostly by the friction and arrangement of the steam connections, which may cause from an inch to a foot difference in level in battery boilers set with free water feeds. This difficulty is largely modified where large steam and mud drums with large necks are used, which allows of a more perfect balance of pressures through all parts of the boiler battery and of the feeding of the entire battery through the mud drum.

(1923) J. P. E. says: A tank measuring 8 feet in height and 5 feet diameter stands 15 feet above ground. Should the supply pipe be made to discharge through the bottom or over the top? What will be the difference in power required to fill the tank, pipe being the same size? A. There is much misunderstanding even among plumbers as to the proper connection of feed and supply pipes for tanks. There is no need whatever for two pipes as you have described. The pump connection should be made at the base of the supply pipe. It not only saves the expense of an additional pipe, but lessens the pressure upon the pump by the value of a hydrostatic column equal to the distance between the water level in the tank and the mouth of the overhead supply pipe. Thus when the tank is empty you will have 3½ pounds per square inch more pressure on your pump piston in pumping over the top than when pumping through the supply pipe. With a full tank the difference is but trifling.

© 1890 SCIENTIFIC AMERICAN, INC.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

February 18, 1890.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adding machine. W. C. Mills ... 421,745
Adding machine, Vance & Brevard ... 421,455
Advertising show case, E. Graf ... 421,639
Aeriform fluids, device for mixing, W. E. Murrin ... 421,603
Agricultural implements, guiding attachment for, C. Packard ... 421,885
Air brake apparatus, pressure indicator for, H. H. Westinghouse ... 421,641
Air compressor, Rand & Halsey ... 421,611
Air engine, Schmid & Beckfeld ... 421,525
Air to motors, means for supplying compressed, McCarten & McNally ... 421,418
Alarm. See Time alarm.
Almond-blanching, machine, C. L. Dexter ... 421,681
Annunciator, Shipway & Dowdell ... 421,439
Annunciator, electrical, A. F. Parks ... 421,508
Annunciator for call boxes, visual, P. Seiler ... 421,882
Ax or edge tool, L. Ricard ... 421,868
Axle journals, packing ring for, J. Loesewitz ... 421,505
Axle lubricator, R. H Parker ... 421,886
Axles, journal box for car, W. O. Dunbar ... 421,485
Bag holder, Angus & Nangle ... 421,648
Baling press, G. W. Arnold ... 421,472
Baling press, A. Wickey ... 421,462
Bandage, J. Teufel ... 421,635
Bar. See Car draw bar.
Barrel, W. Heiser ... 421,570
Battery. See Electric battery.
Beach, means for making, J. Sutherland ... 421,631
Bed pan, M. L. Abraham ... 421,467
Beds, removable sliding for, C. H. Blanken ... 421,656
Belt, electric, M. Wadleigh ... 421,457
Belt loops, manufacture of waist, W. B. North ... 421,752
Belt shifter, G. H. Remington ... 421,515
Bevel, gauge, and trammel, combined, R. P. Jensen ... 421,500
Bicycle bearing, R. S. Crawford ... 421,557
Bicycle fork, J. J. McErlain ... 421,748
Bicycle tires, machine for forming, G. Nauman ... 421,423
Bit braces and tool holders, jaws of, W. H. McCoy 421,420
Blotter, support, F. H. Cutler ... 421,390
Board. See Composite board.
Boiler. See Steam boiler.
Boiler furnace, steam, M. E. Herbert ... 421,863
Book, combined receipt and record, H. Loewenbach ... 421,412
Books, binding for, Miles & Haas ... 421,595
Bottle stopper fastening, J. J. Heim ... 421,402
Bottle stopper, ink or other, J. W. Carter ... 421,667
Boring machine, three-spindle, J. H. Mickler ... 421,417
Box. See Cotton box. Mail box. Sector-shaped box.
Box fastener, J. Robinson ... 421,762
Bracelet, W. Riker ... 421,615
Brake. See Car brake. Vehicle brake.
Brick machines, off-bearing belt for, C. Chambers, Jr ... 421,385
Brick or tile cutting machine, F. E. Frey ... 421,691
Brick shot, G. C. Alexius ... 421,804
Bridle safety attachment, J. Hartmann ... 421,401
Broom hanger, J. F. Draper ... 421,683
Brush, J. C. Bonner ... 421,812
Brushes, apparatus for the manufacture of, L. Strickel ... 421,531
Buckle guard, G. M. Hubbard ... 421,716
Buckle, shoe, Bray & Pope ... 421,660
Buckle, P. Clifford ... 421,553
Buckle, suspender, D. Lippy ... 421,735
Buffer, A. W. Rogers ... 421,763, 421,764
Bung and vent, Lewis & Irish ... 421,732
Buoy for oyster beds, Fagan & Hand ... 421,686
Burner. See Gas burner. Hydrocarbon burner. Sawdust burner. Vapor generating burner.
Button, S. W. Shorey ... 421,441
Button detacher, J. C. Hunt ... 421,717
Buttonhole strip, M. P. Bray ... 421,544
Cable road, E. O. McGlauflin ... 421,507
Camera. See Photographic camera.
Camera and electrical flash-light attachment, G. E. Davis ... 421,484
Can holder, fruit, L. M. Schmidt ... 421,437
Candles, apparatus for finishing wax, G. Grieser ... 421,700
Cane mill, J. E. Hatton ... 421,705
Canopy or awning, J. L. Smith ... 421,772
Car brake, W. Brunquest ... 421,664
Car, cable, J. Stephenson ... 421,628
Car coupling, A. J. Chapel ... 421,671
Car coupling, L. A. Farrar ... 421,825
Car coupling, Heymann & Prosser ... 421,711
Car coupling, J. A. Hinson ... 421,404
Car coupling, Okey & Scroggins ... 421,425
Car coupling, T. L. Rivers ... 421,616
Car coupling, W. Roysdon ... 421,766
Car coupling, H. W. Sprague ... 421,446
Car coupling, O. Stone ... 421,780
Car coupling, F. & A. C. Wendt ... 421,459
Car coupling, street, E. B. Sanborn ... 421,870
Car draw bar, railway, D. L. Barnes ... 421,651
Car driving mechanism, motor, Beckfeld & Siegfried ... 421,476
Car, dumping, S. W. Alfred ... 421,645
Car, dumping, C. W. Raymond ... 421,432
Car, electric railway, H. C. Wirt ... 421,464
Car heater, T. S. Glover ... 421,697
Car heating apparatus, R. H. Soule ... 421,774
Car, locomotive street, J. R. Gathright ... 421,829
Car, metallic, D. L. Barnes ... 421,653
Car, railway, J. N. Barr ... 421,375, 421,376
Car, railway freight, W. Borner ... 421,379
Car replacer, railway, J. V. Slusser ... 421,873
Car, stock, A. G. Steinbrenner ... 421,528
Car wheel, R. N. Allen ... 421,471
Car wheel truing machine, J. N. Barr ... 421,377
Car window screen, L. Landreth ... 421,408
Cars, heating railway, T. S. Glover ... 421,696
Carbon, arc light, Adeney & Saunderson ... 421,469
Carbon for arc lamps, E. L. Liedke ... 421,733
Carding machine for producing slivers of varying colors, R. W. Duxbury ... 421,823
Carriage apron, M. S. Lorsch ... 421,737
Carriage parasol, child's, J. T. Smith ... 421,771
Carrier. See Cash carrier. Cash and parcel carrier. Grip carrier.
Cart, road, J. Haury ... 421,707
Cartridge feeder for machine guns, S. Goodell ... 421,862
Case. See Advertising show case. Packing case. Spectacle case.
Cash and parcel carrier, Dean & Barnett ... 421,822
Cash carrier, A. Waggoner *et al* ... 421,458
Celluloid articles, making and attaching buttonhole sections to, J. R. France ... 421,860
Chair attachment, rocking, A. B. Stevens ... 421,529
Chart, anatomical, G. Henckel ... 421,833
Checkrein hook, W. J. Roe ... 421,435
Chuck, drill, G. H. Ives ... 421,718
Chuck for rock drills, A. C. Rand ... 421,612
Cigarette machine, L. Josselin ... 421,721
Circular bodies, machine for producing, J. N. Barr ... 421,374
Clamp. See Stone saw clamp.
Clapboard holder, B. F. Mooney ... 421,746
Clasp. See Corset clasp. Spring clasp.
Clay elevator, C. Chambers, Jr ... 421,857
Cleaner. See Comb cleaner.
Clock escapement, M. Schwalbach ... 421,622
Cloth shearing or cropping machines, bed for, E. Martin *et al* ... 421,865
Clothes line reel, L. E. Thomas ... 421,452
Clutch, friction, H. J. Gilbert ... 421,694
Coal vase or holder, F. M. Tucker ... 421,787
Cock, compression ball, W. Jameison ... 421,573
Coffee or tea pot handle, G. E. Batsford ... 421,807
Coin-operated machine, P. Schneider ... 421,619
Coke oven, L. N. Knapp ... 421,583
Comb cleaner, J. H. Loose ... 421,413
Combing machine, wool, T. Kennedy ... 421,725
Composite board, W. W. Green ... 421,397
Cooker and cake former for oil meal, combined, Vaile & Tompkins ... 421,454
Corset clasp, F. B. Spooner ... 421,445
Cotton box, revolving, Connell & Johnson ... 421,554
Cotton or hay presses, tramping attachment for, W. W. Adams ... 421,644
Coupling. See Car coupling. Hose coupling. Thill coupling.
Crate, V. Wheat ... 421,534
Crate, fruit, G. Blair ... 421,655
Crushing and grinding mill, T. C. Cadwgan ... 421,481
Cuff holder, E. C. Townsend ... 421,637
Cultivator, L. B. Henry ... 421,710
Cultivator, A. J. Kern ... 421,726
Cultivator, cotton or corn, Busbea & Hearn ... 421,548
Cut-out, G. A. Frei ... 421,396
Cutter. See Feed cutter. Strap cutter.
Cutter head, J. Green ... 421,832
Damper, Jones & Williams ... 421,576
Damper, vertical sand, J. Reuleaux ... 421,516
Decorative frame, R. Marsh ... 421,741
Desk and seat, school, R. B. Hunter ... 421,405
Die. See Screw cutting die.
Dismembering apparatus, W. Hanlon ... 421,493
Door, metallic, D. L. Barnes ... 421,652
Door, sliding, C. O. Brown ... 421,547
Drawhead, T. W. Heintzelman ... 421,495
Drill. See Rock drill.
Drilling machine, J. H. Mickler ... 421,416
Drilling machines, F. H. Richards ... 421,517
Dye, blue azo, A. Weinberg ... 421,640
Earring, H. Rees ... 421,443
Electric battery, Willms & Liebig, Jr ... 421,801
Electric conductor, J. A. Stoughton ... 421,781
Electric connection, flexible, J. F. Wollensak ... 421,802
Electric lock, W. Grah, Jr ... 421,567
Electric locomotion, switch for systems of, F. Wheeler ... 421,535
Electric machine, dynamo, D. B. Brace ... 421,479
Electric motor, P. B. Walsh ... 421,790
Electrical indicator, L. Bock, Jr ... 421,851
Electrode, secondary battery, H. H. Carpenter ... 421,666
Elevator. See Clay elevator. Water elevator.
Elevator, O. S. Harmon ... 421,569
Elevator guard, D. Fraser ... 421,395
Embalming table, G. Ferguson ... 421,393
Engine. See Air engine. Gas engine. Steam engine.
Eraser, envelope opener, and cigar cutter, combined, J. H. Spring ... 421,874
Evaporating pan, J. M. Duncan (r) ... 11,061
Explosive compound, B. Broncs ... 421,662, 421,753
Explosive staff, Heiskell & Drake ... 421,708
Fan, E. W. & J. F. Snow ... 421,626
Faucet, J. Sommer, Jr ... 421,627
Faucet, beer or ale, J. S. Smart ... 421,770
Feed cutter. Sykes & Foust ... 421,632
Feed trough, R. J. Woodworth ... 421,465
Fences, metal picket for, J. E. Emerson ... 421,685
File, letter, J. F. Lash ... 421,409
File, paper, J. A. Fresco ... 421,827
Filter, J. Seabrooks ... 421,521
Filtering press, D. Licht ... 421,503
Fire alarm system, automatic, F. F. Bulen ... 421,853
Fire alarm transmitter, automatic, G. F. Bulen ... 421,854
Firearm, magazine, J. M. & M. S. Browning ... 421,663
Firearms, barrel catch mechanism for, D. B. Wesson ... 421,798
Flags, etc., binding for, R. Kelso ... 421,724
Flask. See Moulder's flask.
Fluids, powders, etc., apparatus for stirring and mixing, R. Handel ... 421,704
Folding screen, J., Jr., & A. K. Carey ... 421,383
Fork. See Bicycle fork.
Frame. See Decorative frame. Spectacle frame.
Frame support, O. C. Blackmer ... 421,542
Fruit stand, F. M. Barber ... 421,540
Fuel, J. Wiesner ... 421,878
Furnace. See Boiler furnace.
Furnace, Lawrie & McMillan ... 421,589
Furnace for heating flat or sad irons, E. G. S. Ricker ... 421,434
Furnace mouth lining, Lamprey & Bugbee ... 421,588
Furnaces, charging, S. T. Wellman ... 421,797
Furnaces, draught regulator for, J. S. Makin ... 421,591
Gang edgers, shifter for, S. H. Pratt ... 421,609
Gas burner, A. G. Morey ... 421,602
Gas engine, H. J. Baker ... 421,473
Gas engine, Beckfeld & Schmid ... 421,474, 421,475, 421,477
Gas engine, Schmid & Beckfeld ... 421,524
Gate, J. S. Shobe ... 421,440
Gate, G. Valentine ... 421,788
Gearing, reciprocating, J. Wenzin ... 421,533
Generator. See Vapor generator.
Glass from pots, removing molten, H. Schulze-Berge ... 421,620
Glass polishing wheel, W. Kimble ... 421,727
Glassware, manufacture of, H. Schulze-Berge ... 421,621
Glove, boxing, J. Stewart ... 421,477
Governor, steam engine, T. & F. A. Scheffler ... 421,871
Grain meter, J. Struble ... 421,875
Graphophone tablet, C. S. Tainter ... 421,450
Grate, rotative fire, H. Born ... 421,378
Grinding and polishing apparatus, W. J. Fisher ... 421,487
Grinding mill, roller, H. Bowman ... 421,658
Grip carrier, J. Stephenson ... 421,629
Grip testing machine, coin-controlled torsional, H. D. Hinckley ... 421,712
Guard. See Buckle guard. Elevator guard.
Guitars, fingering device for, W. E. Page ... 421,426
Gun, air, G. W. Weaver ... 421,793
Gun, breech-loading, G. P. Gunn ... 421,492
Hair braid and ribbon fastener, A. C. Dickinson. 421,682
Hair curling device, W. E. Rushforth ... 421,869
Hair restorer, Crooks & Robin ... 421,675
Hame staple and trace tug clip, Crossan & Devers 421,558
Handle. See Coffee or tea pot handle.
Handle, E. P. Nobbs ... 421,751
Hanger. See Broom hanger. Shaft hanger.
Harness, breast chain for, S. R. Coltebaugh ... 421,817
Harrow, D. W. Inman ... 421,572
Harrow, H. L. Mack ... 421,739
Harrow tooth fastener, W. V. Walker ... 421,789
Harvester, C. Madson ... 421,740
Harvester, corn, D. T. Phillips ... 421,756
Hat and bonnet stand, S. E. L. Wilson ... 421,879
Hat block chuck, C. H. Reid ... 421,513
Hat bow, G. E. Brush ... 421,380
Hat fastener, J. W. Pilkington ... 421,758
Hat finishing lathe, C. H. Reid ... 421,514
Hatchway doors, mechanism for operating, D. B. Clem ... 421,388
Hatchway operating mechanism, R. E. Stewart ... 421,448
Heater. See Car heater. Steam heater. Water heater. Wheat heater.
Heating and ventilating apparatus, T. Dunmore ... 421,562
Hinge, lock, L. Porter ... 421,511
Holder. See Bag holder. Can holder. Clapboard holder. Cuff holder. Paper holder. Sash holder. Signal holder. Stake holder. Tile holder.
Hoof toe contractor and side expander, G. T. Chapman ... 421,672
Hook. See Checkrein hook.
Hose coupling, R. L. Ambrose ... 421,647
Hose wrench, J. S. Smades ... 421,443
Hub, anti-friction, C. J. Applequist ... 421,539
Hydraulic motor, McPherson & Cahoon ... 421,605
Hydrocarbon burner, Bonhack & Hoppe ... 421,543
Hydrocarbon burner, Wilson & Mason ... 421,642
Ice for storing, apparatus for planing cakes of, J. N. Briggs, (r) ... 11,060
Indicator. See Electrical indicator. Station indicator.
Inhaler, steam, M. Schon ... 421,527
Insect excluder for bedsteads, R. McFedries ... 421,604
Insecticide fuel, R. Bessel ... 421,809
Inspection of rooms from a distant point, device for the, G. C. Farr ... 421,687
Insulator, J. W. Davy ... 421,819
Jack. See Lifting jack.
Jar. See Milk jar.
Jaw trap, J. Watkins ... 421,639
Joint. See Metal joint. Rail joint. Railway rail joint. Rotary joint.
Journal bearing, P. Sweeney ... 421,783
Journal box protector, H. S. Pugsley ... 421,610
Kiln. See Lumber kiln.
Kindergarten table, A. W. Potter ... 421,512
Knitting machine, J. Schmitt ... 421,526
Knob, door, C. O. Case ... 421,670
Ladder, step, D. E. Teal ... 421,843
Lamp adapter, electric, J. Stewart ... 421,630
Lamp hanging device, electric, W. H. Layng ... 421,864
Lamp socket, incandescent, W. P. Kookogey ... 421,586
Lamps, wind casing for regenerative gas, T. Gordon ... 421,698
Latch keeper, sheet metal, C. M. Burgess ... 421,381
Lathe feed mechanism, E. A. Muller ... 421,866
Lens, refracting, Kochs & Wolz ... 421,585
Level, spirit, J. A. Traut ... 421,786
Life-raft, D. Kahnweiler ... 421,578
Lifting jack, J. B. & A. Cleveland ... 421,552
Lifting jack, F. B. Mallory ... 421,592
Liquid meter, rotary double piston, H. F. Gaskill. 421,489
Loading apparatus, C. F. Harman ... 421,568
Lock. See Electric lock. Oar lock.
Loom picking motion, power, S. Hamblin ... 421,703
Lounge, invalid, W. L. Dossett ... 421,392
Lubricating device, H. W. Caldwell ... 421,382
Lubricator. See Axle lubricator. Sight feed lubricator.
Lumber kiln, W. A. Fletcher ... 421,690
Mail box, A. S. Wright ... 421,643
Malt, producing caramel, L. Ramsel ... 421,431
Map, E. Eggleston ... 421,684
Marker, cattle, P. De Nagy ... 421,680
Mashing machine, C. Kaestner ... 421,577
Measure and tally, grain, O. D. McDaniel ... 421,421
Measures, drainer for liquid, H. Pannill ... 421,754
Mechanical movement, C. R. Pollard ... 421,608
Metal joint, tubular, L. M. Cottle ... 421,482
Metal with another, machine for regulating the coating of one, J. Monto ... 421,597
Meter. See Grain meter. Liquid meter.
Milk jar, A. V. Whiteman ... 421,461
Milk, preparation of flour from curd of, W. Gerbel ... 421,880
Mill. See Cane mill. Crushing and grinding mill. Grinding mill.
Mining machine, M. A. Michales ... 421,594
Mixing apparatus, G. W. Swan ... 421,883
Moulder's flask, W. N. Gartside ... 421,693
Mordant, C. Wachendorff ... 421,847
Mortising machines, stop mechanism for, B. F. Crow ... 421,859
Motor. See Electric motor. Hydraulic motor. Spring motor. Tidal motor.
Motor, J. H. Lorimer ... 421,726
Mowing machine, J. Phillips ... 421,430
Musical instruments, tail piece for, W. J. Abel ... 421,466
Nut for mica frame bolts, W. J. Keep ... 421,723
Oar lock, J. A. Bailey ... 421,806
Ordnance, breech-loading, J. P. Lavigne ... 421,730
Packing case, telescopic, G. C. Hennig ... 421,496
Packing ring, piston, R. L. Ambrose ... 421,646
Pad. See Stair pad.
Pan. See Bed pan. Evaporating pan.
Paper cutting machine gauge, A. P. Brown ... 421,546
Paper hanging machine, F. H. Miller ... 421,596
Paper holder, printer, and cutter, wrapping, Sprague & Studer ... 421,776
Paper making machine, C. E. Johnson ... 421,574
Paper, toilet, O. H. Hicks ... 421,497
Pavement, J. S. Schaeffer ... 421,618
Pavement, artificial stone block, E. Dart ... 421,183, 421,560
Pen, fountain, A. Reid ... 421,614
Pencil sharpener, E. E. Blakeslee ... 421,810
Pencil sharpener, G. R. Sandell ... 421,767
Pencil tip eraser and twine cutter, combined, G. Weireter ... 421,795
Perforator, F. P. Rosback ... 421,765
Petroleum burners, automatic feeding device for, C. V. Fleetwood ... 421,826
Photographic camera, P. E. Rudell ... 421,436
Pianissimo device, F. H. Toles ... 421,845
Picker for berries, fruits, etc., A. Buchman ... 421,665
Pipe wrench, T. W. Fisher ... 421,688
Pitman connection, H. L. Hopkins ... 421,715
Plane, moulding, R. Kreinberg ... 421,407
Planter, corn, T. L. Cromer ... 421,674
Planter, corn or cotton seed, J. W. Peeler ... 421,755
Planter, potato, A. Loudenslager ... 421,7 8
Pliers, J. Monto ... 421,598
Plow, Mattox & Evans ... 421,506
Plow, S. Tanner ... 421,633
Plow, listing, A. B. Perine ... 421,510
Plowshare, G. S. Briggs ... 421,661
Plows, wheel attachment for, A. Lindgren ... 421,410
Pole and thill, convertible, J. H. Thomas ... 421,451
Pole, sectional metal, J. H. Van Dorn ... 421,532
Post. See Stone post.
Pot. See Straining pot.
Power, apparatus for transmission of, O. Kreil ... 421,587
Power presses, safety treadle for, J. M. Mungiven 421,747
Press. See Baling press. Filtering press.
Printer's galley, W. S. Rogers ... 421,617
Printing from stencils, G. H. Davis ... 421,561
Propeller for steam vessels, A. Cooper ... 421,818
Protector. See Journal box protector.
Pulley, wrought metal, C. O Case ... 421,669
Pulleys, making, C. O. Case ... 421,668
Pulverizer and pug mill, W. J. Boland ... 421,811
Pulverizing apparatus, Herz & Terfloth ... 421,571
Pump, J. Menge ... 421,415
Pump, gas, C. A. MacDonald ... 421,414
Pyrotechnic spinning top, R. F. Nenninger ... 421,424
Quilting machine, M. Koch ... 421,584
Rail for elevated ways, J. W. Davy ... 421,820
Rail joint, key, R. A. Brogan ... 421,545
Railway conduit, electric, P. H. Griffin ... 421,398
Railway grip attachment, cable, J. F. Appleby ... 421,538
Railway mechanism, cable, J. Hartman, Jr ... 421,494
Railway, portable, Bryson, Jr., & Tiers ... 421,813
Railway rail joint, R. I. Verplanck ... 421,456
Railway rail ties, wear plate for, T. A. Davies ... 421,678
Railway signal, electric, W. C. Walter ... 421,791
Railway switch, G. G. Passino ... 421,428
Railway switch, A. J. River ... 421,518
Railway track and tie, P. Semonin ... 421,769
Railway tracks, bulkhead for, T. A. Davies ... 421,679
Railways, automatic block signal system for, W. E. Swin ... 421,842
Railways, traction mechanism for, E. Samuel ... 421,840
Railways with vertical tracks, switch for, C. Zipernowsky ... 421,848
Raisin grader, J. Porteous ... 421,881
Reel. See Clothes line reel. Tape reel.
Refrigerating apparatus, N. W. Condict, Jr ... 421,673
Refrigerator and water filter combined, G. Fleming ... 421,689
Reversing mechanism, R. Scheidler ... 421,523
Ring. See Earring. Packing ring.
Rivet, M. Bray ... 421,659
Rock drill, J. C. Githens ... 421,490
Rock drill, A. C. Rand ... 421,613
Rock drills, tripod for, W. H. Adams ... 421,468
Rock drilling and channeling machine, J. C. Githens ... 421,491
Rock or coal drilling machine, C. B. Dawson ... 421,821
Roll, W. S. Sims ... 421,625
Roll holding, severing, and printing apparatus, J. Nagel ... 421,749
Rotary joint, W. F. Bowers ... 421,657
Rubber, I. Piles ... 421,757
Ruby pin setter, L. W. Greb ... 421,831
Ruler, duplex ledger, S. B. Whiteside ... 421,877
Saddle, side, D. W. Jones ... 421,406
Safety pin shield, J. Jenkins ... 421,720
Salve, R. Weyforth ... 421,799
Sash balance, W. A. Ford ... 421,828
Sash holder, J. A. Baldwin ... 421,849
Sash holder, G. Haupt ... 421,706
Sash holder, J. D. Hopkins ... 421,714
Sash, storm, F. Straub ... 421,782
Saw sharpener, cotton gin, D. McSwean ... 421,422
Saws, back guard for circular, C. A. French ... 421,861
Sawdust burner, F. W. Cook ... 421,555
Sawdust burner, S. L. Miller ... 421,744
Sawing machine feeding device, J. Wurster ... 421,803
Scales, automatic regulator for grain, C. H. Cooley ... 421,556
Scales, computing spring, C. M. Babcock ... 421,805
Scales, drug, R. E. Glover ... 421,695
Screen. See Car window screen. Folding screen. Window screen.
Screw cutting die, T. L. Smith ... 421,773
Seal for cars, etc., A. R. Gibson ... 421,566
Sector-shaped box, C. L. Lockwood ... 421,504
Seed and making, meal from cotton, E. L. Johnson ... 421,575
Seeders, drill attachment for broadcast, N. J. Johnson ... 421,501
Sewing looped fabrics, machine for, A. F. Champlin ... 421,549
Sewing looped fabrics, trimming attachment for machines for, A. F. Champlin ... 421,550
Sewing machine, D. H. Coles ... 421,816
Sewing machine buttonhole attachment, H. J. Williams ... 421,463
Sewing machine, double-thread, C. F. Littlejohn ... 421,590
Sewing machine shuttle operating mechanism, J. E. Bertrand ... 421,808
Sewing machine, sole, J. E. Bertrand ... 421,541
Sewing machine thread feeding mechanism, C. T. Warren ... 421,876
Shaft hanger and engine case, J. T. Case ... 421,856
Shearing or cropping machines, bed for, E. Martin *et al* ... 421,743
Shears, etc., counterbalance for metal, H. Aiken ... 421,537
Sheet metal folder, F. A. Juergens ... 421,722
Shirt, M. Rosenstock ... 421,520
Shoe, W. P. Alden ... 421,470
Shoestring fastener, W. J. Vitt ... 421,633
Sight feed lubricator, W. H. Craig ... 421,389
Signal. See Railway signal.
Signal holder, W. B. Tallman ... 421,784
Signaling apparatus, pneumatic, J. T. Pennycook 421,429
Snow plow, W. H. Lennox ... 421,731
Snow plow, T. Scheffler ... 421,768, 421,841
Sower, broadcast seed, E. C. Tecktonius ... 421,634
Spark arrester, G. H. Shoemaker ... 421,872
Spectacle case, F. Shailer ... 421,438
Spectacle frame, W. X. Stevens ... 421,779
Spike, J. Churchward ... 421,386
Spooling machine, Hamblin & Goldsmith ... 421,400
Spooling machines, spool holder for, Hamblin & Goldsmith ... 421,399
Spools, thread protecting attachment for, D. C. Boley ... 421,478
Spring clasp, J. Nase ... 421,750
Spring motor, Bagley & Neall ... 421,650
Sprinkler. See Water sprinkler.
Stage scenery, J. F. Byrnes ... 421,815
Stair pad, J. A. Rudkin ... 421,839

© 1890 SCIENTIFIC AMERICAN, INC.

Stake holder, adjustable, T. M. Hackett 421,701
Stamp, self-registering canceling, A. C. Sherman. 421,624
Stamp, time, C. H. Shaw 421,623
Stand. See Fruit stand. Hat and bonnet stand.
Station indicator, F. C. Hellmuth 421,709
Steak tenderer, H. C. Burk 421,855
Steam boiler, Clark & King 421,387
Steam boiler, H. Patterson *et al* 421,509
Steam engine, rotating, P. Kirchhoff 421,728
Steam heater, P. Thielen 421,785
Steam trap, R. H. Soule 421,775
Steering wheel carriage, D. Best 421,884
Stone post, artificial, Kimball & Storms 421,582
Stone saw clamp, W. & E. H. Ulrich 421,846
Stopper. See Bottle stopper.
Stove polish, B. C. Frobisher 421,564
Strainer, coffee or tea, N. F. Whipple 421,460
Straining pot, G. C. Stanton 421,777
Strap cutter, H. G. Starr 421,778
Suspenders, M. Rosenstock 421,519
Switch. See Railway switch. Telephone switch.
Table. See Embalming table. Kindergarten table. Tile cutting table.
Table leaf support, F. L. Casper 421,384
Tape reel, F. C. Kendrick 421,835
Telegraph pins, machine for turning, W. W. McNeal 421,654
Telegraph, railway, J. S. Foley 421,394
Telephone mouth piece, Whitney & Cowles 421,800
Telephone switch. E. C. Titus 421,636
Thermostat, G. F. Bulen 421,852
Thill coupling, W. H. Gailor 421,565
Thill couplings, anti-rattler for, D. Holden 421,713
Tidal motor, J. H. B. Rankin 421,761
Tile, E. C. Lindemann 421,734
Tile cutting table, F. E. Frey 421,692
Tile holder, R. Marsh 421,742
Tile laying machines, flexible carrier for, H. M. Fisk 421,438
Time alarm, G. H. Straight 421,530
Tinners' articles in the grease pot, machine for immersing, J. Monto ..... 421,599 to 421,601
Tongue support, J. A. Lemmon 421,502
Tool attachment, J. H. Dixon 421,391
Toy locomotive, G. S. Crosby 421,676
Trap. See Jaw trap. Steam trap. Water trap.
Trolley wire support, J. H. Cunningham 421,677
Treadle, pendulum bar, E. A. Cochran 421,858
Trough. See Feed trough.
Truck, car, W. H. Marshall 421,593
Truck, hand, J. Annin 421,649
Trunk, H. P. Sleigh 421,442
Tuyere, water, F. G. Nordmann 421,867
Typewriter, J. F. McLaughlin 421,838
Typewriting machine, J. Hall 421,702
Typewriting machine, J. F. McLaughlin 421,836, 421,837
Typewriting machine, A. A. Wilcox 421,536
Umbrella, J. McCormick 421,419
Valve, automatic cut-off, C. W. Tremain 421,453
Valve controller, electro-magnetic, J. V. Stout 421,449
Valve, exhaust, B. V. Nordberg 421,606
Valve for air brakes, car reservoir relief, H. S. Park 421,427
Vapor burner cone, C. A. Pope 421,759
Vapor generating burner, G. Littlefield 421,411
Vapor generator and burner, petroleum, B. B. Christie 421,551
Vaporizer and burner, oil, E. Ralph 421,760
Vaporizing liquid hydrocarbons and supplying the vapor to burners, apparatus for, C. M. Hollingsworth 421,834
Vehicle brake, A. Paul 421,607
Vehicle brake, Seat & Perkins 421,522
Vehicle pedestal, T. Hill 421,403
Vehicle, two-wheeled, D. F. Kain 421,579
Vehicle, two-wheeled, D. Snyder 421,444
Veterinary surgical instrument, D. J. Bunce 421,814
Wagon, buckboard, Webster & Kimball 421,794
Watches or other timepieces, repeating mechanism for, F. Terstegen 421,844
Water and generating steam by electricity, apparatus for heating, J. C. Hubinger 421,498
Water and generating steam by electricity, heating, J. C. Hubinger 421,499
Water elevator, G. V. Killian 421,581
Water heater, R. G. Ward 421,792
Water sprinkler, W. S. Kisinger 421,729
Water trap, condensed, I. Cumberbatch 421,559
Weighing machine, automatic grain, W. T. Barker 421,850
Well boring apparatus, L. V. Elder 421,486
Wheat heater, J. E. Welch 421,796
Wheel. See Car wheel. Glass polishing wheel.
Whiffletree connection, O. J. Fisk 421,580
Windlass, T. H. Brady 421,480
Windmill, M. G. Kendrick 421,580
Window, O. M. Edwards 421,563
Window screen, G. A. Jacobs 421,719
Wrench. See Hose wrench. Pipe wrench.
Yarn, making roving for the manufacture of spotted or partly colored or clouded, R. W. Duxbury 421,824

DESIGNS.

Carpet, T. L. Lawton ..... 19,654 to 19,657
Dish, C. E. Haviland 19,651
Fork, etc., J. T. Curran 19,650
Parasol, S. Heiter 19,652, 19,653
Stove, T. I. Rankin 19,662
Tape, ornamentation of, O. A. Steere 19,658
Terret, P. Gschwend 19,661
Type border, combination, H. Ihlenburg 19,659
Type, font of, H. Ihlenburg 19,660

TRADE MARKS.

Anæsthetic, local, Cobb & Merriam 17,545
Anodyne medicine, J. T. Smith 17,556
Cement for repairing broken articles, M. Major 17,570
Cloths and serges, Italian, J. Maddocks & Co 17,548
Collars and cuffs, Water Lily Kollar and Kuff Company 17,576
Electrical purposes, wire for, Electrical Supply Company 17,564
Ginger, mustard, allspice, cloves, pepper, and cinnamon, Tone Bros 17,558
Gloves, H. Robitsek & Co 17,572
Lard, Hand Brothers 17,545
Lard and hog and beef products, J. H. Michener & Co 17,549
Lard, refined or leaf, Rieman & Co 17,555
Liniment, W. M. Smith 17,573
Medicine for bronchial and pulmonary affections, Choate Drug & Chemical Company 17,563
Oil, olive, Brandenburg Freres 17,539
Paper, writing, Worthy Paper Company 17,559, 17,560
Pens and like goods, fountain, Harman & Strauss 17,546
Pens, metallic, Esterbrook Steel Pen Manufacturing Company 17,565
Pottery ware, M. L. Storer 17,575
Preserved fruits, F. Reiset & Co 17,554
Remedy for whooping cough, M. P. Purdy 17,571
Salt, Lone Star Salt Company 17,568
Scissors, knives, axes, and razors, F. A. Clauberg 17,542
Soap, Procter & Gamble ..... 17,550 to 17,553
Soap, G. & G. Stern 17,557
Soap, scouring, B. Brooke & Company 17,540
Soaps and cleansing and polishing powders, Callustro Company 17,541
Tea, Japan, G. W. Lane & Co 17,547
Tiles for flooring, etc., encaustic, American Encaustic Tiling Company 17,538
Tobacco, smoking, D. R. Carroll 17,562
Toilet preparations for the face and hands, including soaps, and cosmetics, W. H. Galbraith 17,566
Vegetable compound, a remedy for Bright's disease, dyspepsia, and scrofula, J. B. Anderson 17,561
Wash tubs, and frames, stationary solid and white crokery, A. J. Stewart 17,574
Watches, Illinois Watch Case Company 17,567
Whisky, Gottschalk Co 17,544
Whisky, F. F. Lutz 17,569

A Printed copy of the specification and drawing of any patent in the foregoing list will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated, the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page. each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

USE ADAMANT WALL PLASTER

It is **Hard, Dense, and Adhesive.** Does not *check or crack.* It is impervious to wind, water, and disease germs. It dries in a few hours. It can be applied in any kind of weather. It is in general use. Licenses granted for the mixing, using, and selling.

Address **ADAMANT MFG. CO.**
309 E. Genesee St., Syracuse, N. Y.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **59.** Price 10 cents. To be had at this office and of all newsdealers.

"Star" Foot Lathe Swings 9x25 in.
LATHE
Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery.

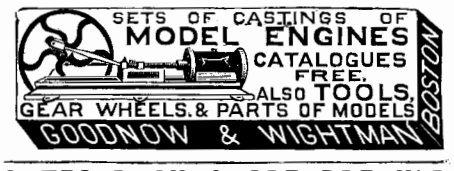
Seneca Falls Mfg. Co., 695 Water St., Seneca Falls, N. Y.

Owing to dissolution of partnership,
C. H. DE LAMATER & CO.
have closed their extensive manufactory at the foot of West 13th Street, New York, disposed of Hot Air Pumping Engine and Steam Pump business to the DE LAMATER IRON WORKS (incorporated 1889), and to close out the remainder, offer for sale a very desirable lot of lathes, planers, drilling, shaping, slotting, boring, cutting off, nut tapping, bolt cutting, and milling machines, gear cutters, emery tool grinders, screw machines, vises, lathe and planer tools, drills, taps, and a variety of small tools, boiler punching and shearing machines, with lot of small tools, anvils, sledges, tongs, blocks, rope, bolts, nuts, washers, packing, pipe, fittings, brass valves, bar iron and steel, steam hammers, and three Rider cut-off engines.

Bellville Non-Explosive Boiler

The exclusive privilege to manufacture in this country for sale. It is highly recommended for both marine and land purposes. Thousands of horse power used in France, Belgium, and Russia, and there is no question of its being the only marine boiler of its type practically successful through a prolonged period of time.

Apply to Executors of C. H. DE LAMATER,
Foot of West 13th Street, New York.



GATES ROCK & ORE BREAKER
Capacity up to 150 yards per hour.

Has produced more ballast, road metal, and broken more ore than all other Breakers combined.

Send for Catalogues.
GATES IRON WORKS
50 C So. Clinton St., CHICAGO.

$3 PRINTING PRESS. Do all your own printing. Save money. Catalogue for two stamps. **Kelsey & Co.,** Meriden, Conn.

STEEL TYPE for TYPEWRITERS,
Stencils, Steel Stamps, Rubber and Metal Type Wheels.
New York Stencil Works, Mfrs.
100 Nassau Street, New York.

ABSOLUTELY AIR AND OIL TIGHT.
Patent Pocket Oiler and Sheath

Handiest Oiler in the market. Releases *one* drop of oil, no waste or leakage. For guns, bicycles, typewriters, fine machines, etc. Send 25c. for sample.
Bridgeport Gun Implem't Co., 17 Maiden Lane, N.Y.

PRESSES. 50 TO 500 TONS, by Hand or Power.
For almost every purpose requiring pressure
BOOMER & BOSCHERT PRESS CO.
Send for Catalogue. 155 West Water Street, Syracuse, N. Y., U. S. A.

SEBASTIAN, MAY & CO'S
Improved Screw Cutting
Foot & Power **LATHES**

Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. *Lathes on trial.* Catalogues mailed on application.
165 W. 2d St., Cincinnati, O.

SPECIAL NOTICE!
We have recently issued a priced Catalogue of **MINING, TUNNELING & QUARRYING MACHINERY.** This is a large volume, profusely illustrated and compiled with the view of placing intelligently before the public **Facts** and **Figures** relating to Equipment, Cost, and Operation of **Mining, Tunneling,** and **Quarrying Plants.** It will be mailed free to any one interested or engaged in **ROCK EXCAVATION or COMPRESSED AIR.** To others it will be sent on receipt of 50 cents in stamps.
INGERSOLL-SERGEANT ROCK DRILL CO.
No. 10 Park Place, New York, U. S. A.

ROCK DRILLS
AIR COMPRESSORS &
GENERAL MACHINERY FOR
MINING, TUNNELING,
QUARRY & RAILROAD WORK.

RAND DRILL Co 23 PARK PLACE NEW YORK

ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **1.** The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

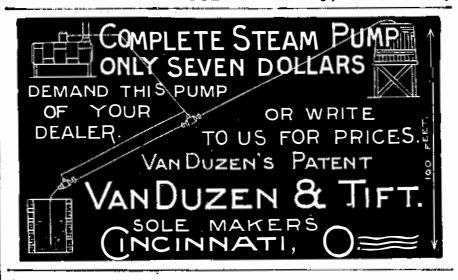
REMINGTON

STANDARD TYPEWRITER.
Gold Medal—Paris Exposition, 1889.
Wyckoff, Seamans & Benedict
327 BROADWAY, NEW YORK.

CHICAGO NICKEL WORKS.
MANUFACTURERS OF
Sohn's Patent Foot Rest,
And Other Metal Specialties.

We make a specialty of manufacturing on contract all kinds of metal articles, small machinery, etc. Have the largest nickel-plating works in the west. Obtain our estimate on work and submit meritorious patents for manufacture and sale.
CHICAGO NICKEL WORKS, 93 & 95 E. Ohio St. Chicago

Scientific Book Catalogue
RECENTLY PUBLISHED.
Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.



ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116.** Price 10 cents. To be had at this office and of all newsdealers.

GEARS
BRASS RACKS & PINIONS.
8 Medford Street,
Circular Free. **T. F. WELCH, BOSTON.**

The Lunkenheimer Brass Mfg. Co.
CINCINNATI, OHIO.

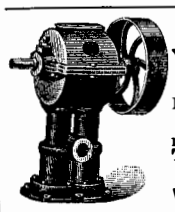
Write for Catalogue and Prices of Regrinding Globe Valves, Gate Valves, Pop Safety Valves, Sight-Feed Lubricators, and Glass Oil Cups, etc., etc.

USEFUL BOOKS.
Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address,
MUNN & CO., 361 Broadway, New York.

BARREL, KEG, Hogshead, AND STAVE MACHINERY.
Over 50 varieties manufactured by
E. & B. HOLMES,
Chamfering, Howeling, and Crozing. **BUFFALO, N. Y.**

TOOL AGENTS WANTED
in every **SHOP** in the United States.
Send 10c. for Catalogue, Stationery &c.
THE FINEST OF MECHANICAL TOOLS A SPECIALTY.
C.B. JAMES, 98 LAKE ST. CHICAGO.

ELECTRO MOTOR, SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

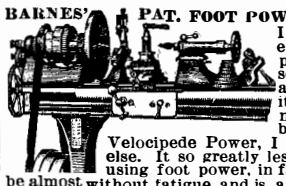


The CHANDLER WATER MOTOR
Works well on **Low** and **High** Pressures.
Single, Duplex, Triple, and Quadruple Automatic **PISTON MOTORS,** *adapted to all classes of work.*
Send for Circulars.
WM. H. LOCK, Buffalo, N. Y.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **632.** Price 10 cents. To be had at this office and from all newsdealers.

INVENTORS
We make a specialty of manufacturing and selling **advertising novelties.** We buy patents in this line, or manufacture and sell on royalty. We employ a large number of bright agents. Correspondence solicited. WILBUR PUBLISHING CO., 541 The Rookery, Chicago.

BARNES' PAT. FOOT POWER MACHINERY.



I feel so highly pleased with your Velocipede Foot Power with seat, that I wish to add my testimony to its superiority. I did not expect to like it, but having used the Velocipede Power, I would have nothing else. It so greatly lessens the fatigue of using foot power, in fact, it may be said to be almost without fatigue, and is a steadier motion. I only wish I had known of it sooner. Send for catalogue. W. F. & J. BARNES CO., 999 Ruby St., Rockford, Ill.

THE Scientific American
ESTABLISHED 1846.
The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete List of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies 10 cents. Address and remit by postal order, express money order, or check,
MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid **Magazine of Architecture,** richly adorned with *elegant plates in colors,* and with other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

© 1890 SCIENTIFIC AMERICAN, INC.

A Great Repository of Practical and Scientific Information.

One of the Fullest, Freshest, and Most Valuable Handbooks of the Age. Indispensable to Every Practical Man.

NOW READY.

Price $2.00.

Free of Postage to any Address in the World.

The Techno-Chemical Receipt Book:

Containing Several Thousand Receipts, covering the Latest, most Important, and most Useful Discoveries in Chemical Technology, and their Practical Application in the Arts and the Industries. Edited chiefly from the German of Drs. Winckler, Elsner, Heintze, Mierzinski, Jacobsen, Koller, and Heinzerling, with additions by William T. Brannt, Graduate of the Royal Agricultural College of Eldena, Prussia, and William H. Wahl, Ph. D. (Heid.), Secretary of the Franklin Institute, Philadelphia, author of "Galvanoplastic Manipulations." Illustrated by 78 engravings, one volume, over 500 pages, 12mo, elegantly bound in scarlet cloth, gilt, closely printed, containing an immense amount and a great variety of matter.

Price $2.00, free of postage to any address in the world.

☞ *A circular of 32 pages, showing the full Table of Contents of this important Book, sent by mail free of postage to any one in any part of the World who will furnish his address.*

HENRY CAREY BAIRD & CO.
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U.S.A.

PENS AND TYPES

Hints and Helps for those who Write, Print, Teach, Read or Learn.

By BENJAMIN DREW.

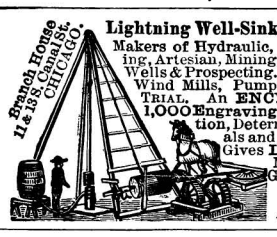
Price, - - - - - - - - $1.25

A New and Improved Edition.

This is a very valuable book for both professionals and amateurs in literature. In a plain and comprehensive manner the author gives invaluable instruction concerning writing for the press, proof-reading, style, punctuation (an especially valuable chapter), orthography, reading Greek, etc.

Sold by all booksellers, and sent postpaid, on receipt of price. Catalogues sent free.

LEE & SHEPARD, Publishers, BOSTON.

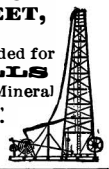


Lightning Well-Sinking Machinery.
Makers of Hydraulic, Jetting, Revolving, Artesian, Mining, Diamond, Tools, Wells & Prospecting Engines, Boilers, Wind Mills, Pumps, etc., SOLD ON TRIAL. An **ENCYCLOPEDIA** of 1,000 Engravings, Earth Stratification, Determination of Minerals and Quality of Water. Gives Light, finds Gold. Mailed for 25 cts. Gas Book 25 cts.
The American Well Works,
AURORA, ILLS

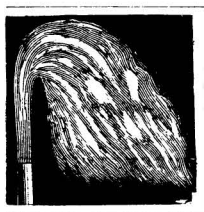
THE STORAGE OF ELECTRICITY.—A valuable review of the present aspect of storage battery development, with a comparison of different cells, and their weight and capacity. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. **687.** Price ten cents. To be had at this office and from all newsdealers.

OIL WELL SUPPLY CO. Ltd.

91 & 92 WATER STREET,
Pittsburgh, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.



COMPOSITE GEARING.—BY PROF. C. W. MACCORD, Sc.D. How to construct the teeth of a wheel in which the involute and epicycloidal systems are so combined as to secure advantages which could not, under the given conditions, be realized by the use of either system alone. With 3 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **695.** Price 10 cents. To be had at this office and from all newsdealers.



ARTESIAN

Wells, Oil and Gas Wells, drilled by contract to any depth, from 5c to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue. **Pierce Artesian and Oil Well Supply Co.,** 80 Beaver Street, New York.

USE Perforated Electric Belting

—FOR—

SWIFT RUNNING MACHINERY.

Write for Descriptive Catalogue to

CHAS. A. SCHIEREN & CO.
45-51 FERRY ST., NEW YORK.

Penberthy Automatic Injector.
Cost less than others and do equal work. Lift 20 feet and work from head as well. Restart themselves and require no watching. Will lift through hot pipes, work from 25 to 150 lbs. pressure. Parts removable without disconnecting, also interchangeable. Send for pamphlet.
Penberthy Injector Co., Detroit, Mich.
Donegan & Swifts, 174 Fulton St., New York.
Park & Lacy, San Francisco.
L. M. Rumsey Mfg. Co., St. Louis.

THERMOMETERS.—A VALUABLE PAPER upon the history, manufacture, uses, calibration, and various forms of Thermometers. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **693.** Price 10 cents. To be had at this office and from all newsdealers.

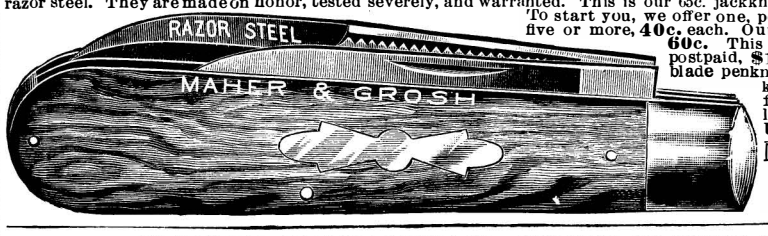
CLARK'S NOISELESS RUBBER WHEELS.
Absolutely prevents splintering and wearing of floors caused by use of iron wheels. Adapted for Trucks, Boxes, Baskets, Tables and work of every kind in Mills, Warehouses, etc. Also furniture casters. Catalogue free.
Geo. P. Clark Box L Windsor Locks, Conn.

PERFECT NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, Magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN" in gilt. Necessary for every one who wishes to preserve the paper. Address
MUNN & CO., Publishers SCIENTIFIC AMERICAN.

HOW NOT TO HELP.

Thousands read our ads., are then interested in our goods, but instead of sitting down and ordering from us, or getting our catalogue, they drop into the local store and ask for a **Maher & Grosh** knife or razor. The dealer has none, for we do not drum the middlemen, but he has something "as good." He sells a knife that was made **to sell,** and our friend is sold too. Our adv. is for the purpose of getting into direct trade with consumers; once secured, he is ours forever. The Maher & Grosh **knives, razors, scissors, etc.,** are hand forged from razor steel. They are made on honor, tested severely, and warranted. This is our 65c. jackknife, well worth $1.



To start you, we offer one, postpaid, for **45c.,** five or more, **40c.** each. Our best 7 in. Shears, **60c.** This knife and shears, postpaid, **$1.** Elegant three blade penknife or strong shop knife, **$1.** Send for 80 page free list, and "How to Use a Razor."

Maher & Grosh,
40 S Street,
Toledo, Ohio.

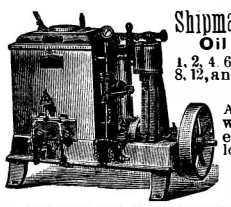
WEITMYER PATENT FURNACE. BOILERS OF EVERY DESCRIPTION.
IDE AUTOMATIC ENGINES. Traction and Portable Engines.
STEAM ROAD ROLLERS.
Manufactured by FOUNDRY & MACHINE DEPT., Harrisburg, Pa., U. S. A.

SEATTLE

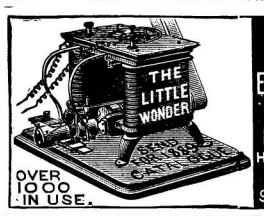
The "Queen City" and Metropolis of the New State of Washington

For Illustrated Descriptive Matter write to the Leading Real Estate and Financial Brokers Seattle.

Crawford & Conover



Shipman Automatic Steam Engine
Oil or Natural Gas Fuel.
1, 2, 4, 6, and 8 Horse Power Single, 8, 12, and 16 Horse Power Compound
Over 2,500 In Actual Use.
Automatic in both fuel and water supply, requiring no engineer. Send for Catalogue. Mention SCI. AM.
Shipman Engine Co.,
200 Summer Street.
Boston, Mass.



NICKEL AND ELECTRO-PLATING APPARATUS AND MATERIAL
HANSON, VAN WINKLE & CO.
NEWARK, N.J.
92 LIBERTY ST. N.Y.

SHAPING SHEET METAL.—DESCRIPTION of a method of shaping zinc, copper, and other ductile metals by fluid pressure. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **695.** Price 10 cents. To be had at this office and from all newsdealers.

TYPEWRITERS

Send for New Illustrated Catalogue describing all Machines. Largest stock in America.
New or Second-hand Typewriters of all makes.
Machines Rented in any part of the country. Supplies in abundance. Prices the lowest.
NATIONAL TYPEWRITER EXCHANGE,
161 La Salle Street, Chicago, Ill.

FOR LINING WALLS AND FLOORS TO PREVENT WARMTH ESCAPING AND DEADENING SOUND, USE **MINERAL WOOL.** SAMPLES AND CIRCULARS FREE
U.S. MINERAL WOOL CO.
2 CORTLANDT ST. NEW-YORK CITY, U.S.A.

ADVERTISER IS OPEN TO BUY OR TO work on Royalty the British Patent of any good invention. Buys also Novelties of all kinds. Bankers' references. Correspondence and samples solicited. T. M. CLARKE, ROMILEY, MANCHESTER, ENGLAND.

2nd MACHINERY Lists Sent.
N. Y. Mach'y Depot, Bridge Store 16, Frankfort St., N.Y.

ASBESTOS Fire Felt Coverings, Packings, Sheathings, &c.
The CHALMERS-SPENCE CO., Mfrs.
419-425 8th Street, East River, N. Y.

MODELS!
Experimental Work, Light and Special Machinery to order. N. ERLANDSEN, 107 Rivington St., New York.

INVENTORS and others desiring new articles manufactured and introduced, address P. O. Box 86, Cleveland, O.

HARRISON CONVEYOR!

For Handling **Grain, Coal, Sand, Clay, Tan Bark, Cinders, Ores, Seeds, &c.**
Send for Circulars. | **BORDEN, SELLECK & CO.,** {Sole Manu'f'ers,} **Chicago, Ill.**

MOSS ENGRAVING CO. 535 PEARL ST NEW YORK.

cor. Elm St.

ENGRAVINGS FOR BOOKS, NEWSPAPERS and CIRCULARS

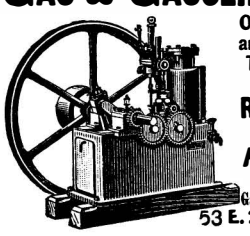
SEND GREEN STAMP FOR CIRCULAR — SEND PHOTOGRAPH, DRAWING OR PRINT FOR ESTIMATE

When writing to us please mention SCIENTIFIC AMERICAN.

CELEBRATED SUTTON RING PACKING.
PIONEER RUBBER PACKING. POSITIVELY ANTI FRICTION, SPECIALLY ENDORSED FOR HIGH SPEED ENGINES
SEND FOR SAMPLE PACKAGE AND PARTICULARS TO ERIE RUBBER CO ERIE PA U.S.A.

ELECTRICITY, LIGHT AND HEAT.—A lecture by Prof. C. F. Brackett, delivered before the New York Electric Club—Facts about electrical conductors. Production of electric light in the cheapest possible way. The relations between the three vibratory forces and the significance of Herz's recent experiments. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **683** and **684.** Price 10 cents each. To be had at this office and from all newsdealers.

VAN DUZEN GAS & GASOLINE ENGINE



OPERATED with COAL and OTHER MANUFACTURED GASES AND GASOLINE.
RELIABLE AND ECONOMICAL.
Fully Warranted
VAN DUZEN
Gas & Gasoline Engine Co.
53 E. 2d St., Cincinnati, O.

Factories Wanted

At **EAST CHATTANOOGA,** adjoining **CHATTANOOGA TENN.,** the Hub of the South and centre of coal and iron industry.

Population in 1880, 13,000; 1885, 25,000; 1889, 55,000. Cheap iron, coal, wood, and labor. Low taxes. River front. Nine railroads, more building, giving cheap railroad and water transportation in all directions. Climate, water supply, and drainage unsurpassed. Free sites and other inducements to manufacturers.

For full particulars, address **EAST CHATTANOOGA LAND CO., Chattanooga, Tenn.,** or L. B. RUSSELL, Sec'y, 96 Summer St., Boston, Mass.

HOW TO MAKE DYNAMO-ELECTRIC Machines.—By Geo. M. Hopkins. With drawings to scale and full directions for constructing dynamos of different sizes. The small machine is intended for experimental purposes. Will heat from 4 to 6 inches of platinum wire, produce the electric light, decompose water rapidly, magnetize steel, ring a large gong, give powerful shocks, operate induction coils, and will, for temporary use, replace 8 or 10 Bunsen cells. Contained in SUPPLEMENTS **161** and **599.** Price 10 cents each. The larger machine produces eight 16-candle lights or one powerful arc light. Can be arranged as a series, shunt, or compound wound machine. Can be run for a short time by two or four men. Requires one horse power for continued running. Best engravings of dynamo ever produced. Details of every part shown. Winding of armature and field magnet plainly illustrated. Any intelligent person with the aid of these drawings and instructions may make useful, durable, and effective machines. Contained in SUPPLEMENT **600.** Price 10 cents. MUNN & CO., PUBLISHERS, 361 Broadway, New York.

THE BEST LIME KILN KNOWN
or no pay. C. D. PAGE, Rochester, N. Y.

ON GAS ENGINES.—A VALUABLE paper by E. Delamare-Debouteville, touching upon the history of gas motors in general, and describing in detail the "Simplex" engine invented by the author and Mr. Malandin. With 23 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **715** and **716.** Price 10 cents each. To be had at this office and from all newsdealers.

THE PENNA. DIAMOND DRILL & MFG. CO.
BIRDSBORO, PA., Builders of High Class Steam Engines, Diamond Drilling and General Machinery. Flour Mill Rolls Ground and Grooved.

THE STEAM ENGINE; ITS PRINCIPLES, its development, its future and perfection.—A paper by E. N. Dickerson, giving an outline of the history of the steam engine, and discussing the principles upon which it operates and which limit its capacity. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **686.** Price 10 cents. To be had at this office and from all newsdealers.

AGENTS WANTED by an old reliable firm; large profits quick sales, **SAMPLE FREE.** A rare opportunity. **Geo. A. Scott, 842 Broadway, N. Y**

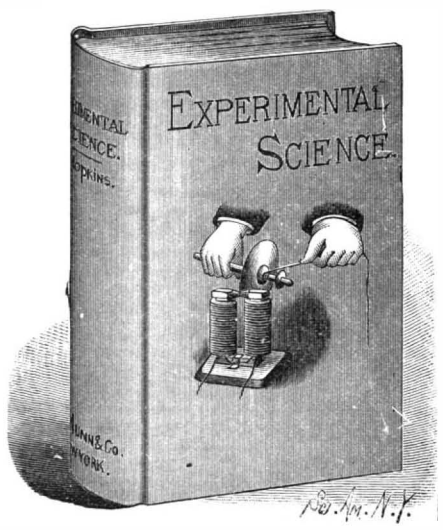
DEAFNESS & HEAD NOISES CURED by Peck's INVISIBLE TUBULAR EAR CUSHIONS. Whispers heard. Comfortable. Successful where all Remedies FAIL. Ills. book & proofs free. Address **F. HISCOX, 853 Broadway, New York.**

CUTLER DESK. BEST IN THE WORLD.
A. CUTLER & SON, BUFFALO, N.Y., U.S.A.

PULLEYS HANGERS, FRICTION CLUTCHES. PROGRESS MACHINE WORKS, A. & F. BROWN, 44 Park Place, N. Y.

NOW READY.

Experimental Science,



By GEO. M. HOPKINS.

740 Pages. 680 Illustrations.

PRICE, by mail, postpaid, ... $4.00

SEND for FREE ILLUSTRATED CIRCULAR and Table of Contents.

MUNN & CO., Publishers,
Office of The Scientific American,
361 Broadway, New York.

Proposals for Boiler Tubes for the Mare Island Navy Yard.—February 10, 1890.—Sealed proposals endorsed "Proposals for Boiler Tubes for the Mare Island Navy Yard, to be opened March 15, 1890," will be received at the Bureau of Provisions and Clothing, Navy Department, Washington, D. C., until 12 o'clock noon, March 15, 1890, and publicly opened immediately thereafter, to furnish at the U. S. Navy Yard, Mare Island, California, 640 boiler tubes for the U. S. S. "Alert." Blank forms of proposals will be furnished upon application to the Bureau Commandant, Mare Island, or the Navy Pay Office, San Francisco, Cal. The articles must in all cases conform to the naval standard, and pass the usual inspection. Tie bids decided by lot. The Department reserves the right to waive defects or to reject any or all bids not deemed advantageous to the Government.
JAMES FULTON, *Paymaster General, U. S. Navy.*

FAMILY ICE MACHINE Ice in few minutes Price, $7.50 to $140 Circular. L. Dermigny, 126 West 25th Street, New York.

Those interested in Adjustable Gripping System for mountain and level cable roads, and which crosses transverse cables and stops cars on the worst inclines, address N. Kirchner, Patentee, 6 So. Del Ave., Phila., Pa.

INJECTORS. WANTED—A competent salesman familiar with the R. R. trade. Address RAILROAD, P. O. Box 1592, Philadelphia, Pa.

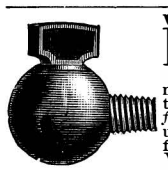
Cheap Printing Do it yourself. Circular press $8. Size for small newspaper, $44. Everything easy, printed rules. Send two stamps for Catalogue to factory. **KELSEY & CO., Meriden, Conn.**

A NEW CATALOGUE OF VALUABLE PAPERS

Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, New York.

DO you use **"Brown's Incombustible Machinery Wipers?"** $6 per gross. Discount to dealer. J. G. BOWDEN, Gen. Agt., 33 Kingston St., Boston, Mass., U.S.A.

SECURITY AGAINST THE DISTURBANCE of Ships' Compasses by Electric Lighting Apparatus.—A paper by Sir William Thomson, discussing a new source of danger to ships from the effects of dynamos upon the adjustment of compasses. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **709.** Price 10 cents. To be had at this office and from all newsdealers.



Van Duzen's Pat. Loose Pulley Oiler HAS Highest Indorsements, Enviable Reputation, Scientific Pedigree.
A two years' test by conservative manufacturers of national reputation has shown it to be the *only perfect Lubricator for Loose Pulleys* in use. Prices very reasonable. Send for our "Catalogue Number 55."
VAN DUZEN & TIFT, Cincinnati, O.

INVENTORS!—We make anything you want from a Screw to Complete Working Model. Inventions perfected, details worked out, drawings made. Repairs. Circulars sent. A. J. WEED & CO., 92 Fulton St., N. Y.

The Scientific American PUBLICATIONS FOR 1890.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly) one year	$3.00
The Scientific American Supplement (weekly), one year	5.00
The Scientific American, Spanish Edition (monthly) one year	3.00
The Scientific American, Architects and Builders Edition (monthly), one year	2.50

COMBINED RATES.

The Scientific American and Supplement	$7.00
The Scientific American and Architects and Builders Edition	5.00
The Scientific American, Supplement, and Architects and Builders Edition	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

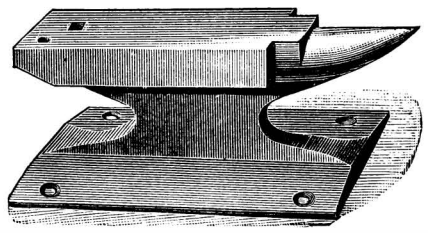
WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E Co., Cin'ti O.

© 1890 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



This is a Solid Forged Steel Anvil with polished face, sides, and horn.

NO.	LONG.	WIDE.	WEIGHT.	PRICE
1	7 inches	1½ inches	5 lbs.	$2.00
2	8 "	2 "	7 "	2.50
3	9 "	2 "	9 "	3.00

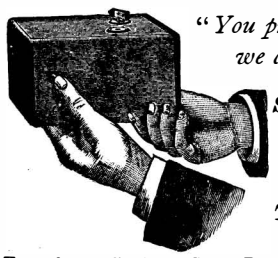
Express C. O. D., or may be had from most Hardware Dealers. **MILLERS FALLS CO.,**
93 Reade Street, New York.

Wheeling is Better than Walking.

Victor Bicycles
Are Better than Any Others.
Catalogue Free.
Overman Wheel Co., Makers,
Chicopee Falls, Mass.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

NEW KODAKS



"You press the button, we do the rest."

Seven New Styles and Sizes
ALL LOADED WITH
Transparent Films.

For sale by all Photo. Stock Dealers.
THE EASTMAN COMPANY,
Send for Catalogue. *ROCHESTER, N. Y.*

PAPER AND CEMENT Manufacturers wanted to correspond with parties manufacturing very strong Vanilla Paper for iron pulley covers, and those making a Cement for iron. Address J. E. EMERSON, Beaver Falls, Pa.

COLUMBIA CYCLES
FOR 1890
-ORDINARIES,-
• LADIES' AND GENTLEMEN'S •
SAFETIES, TANDEM SAFETIES,
-TRICYCLES.-
HIGHEST · GRADE ONLY
LARGE ILLUSTRATED CATALOGUE SENT FREE
POPE MFG. CO. 77 FRANKLIN ST. — 12 WARREN ST. — 291 WABASH AVE.
BOSTON. NEW YORK. CHICAGO.

TO BUSINESS MEN

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page, or address **MUNN & CO., Publishers,**
361 Broadway, New York.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS. FINE TINNING JAPANNING AND FINISHING. THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA.

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

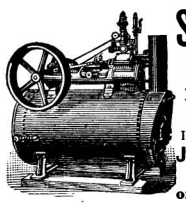
MUNN & CO., Solicitors of Patents,
361 Broadway, New York.
BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

THE GUTTA PERCHA & RUBBER MFG. CO.

The Largest Manufacturers of Mechanical Rubber Goods in the World.
ESTABLISHED 1855.
Packing, Belting, Hose, Mats, Matting, etc.
35 WARREN STREET, NEW YORK.
Chicago. San Francisco. Portland, Oregon. Boston, Mass.

NATIONAL FILTER.
Special Size to Filter Entire Supply of Water for House.
GUARANTEED TO PRODUCE
BRIGHT SPARKLING WATER
If Filter is Cleaned Once Each Day. Can be Cleaned in 10 Minutes.
LARGE SIZES FOR MILLS AND WATER WORKS.
NATIONAL WATER PURIFYING CO.,
Address for Pamphlet. **145 Broadway or 86 Liberty St., New York.**

THE MODERN ICE YACHT. — BY Geo. W. Polk. A new and valuable paper, containing full practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **624.** Price 10 cents. To be had at this office and of all newsdealers.



STEAM ENGINES
Upright and Horizontal, Stationary, Portable and Semi-Portable.
8 to 16 Horse Power.
Illustrated Pamphlet Free. Address
JAMES LEFFEL & CO.
SPRINGFIELD, OHIO,
or 110 Liberty St., New York.

JAMES B. EADS.—AN ACCOUNT OF the life and labors of this eminent engineer. With a portrait. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **592.** Price 10 cents. To be had at this office and from all newsdealers.

$15 THE ONLY PRACTICAL LOW-PRICED TYPEWRITER
Catalogue free. Address Typewriter Department, POPE MFG. CO., Makers of **Columbia Cycles,** Boston, New York, Chicago.

FLORIDA STEAM AND HOT WATER HEATERS.
FOR WARMING RESIDENCES, STORES, HOTELS, BUSINESS BLOCKS, SCHOOLS AND PUBLIC BUILDINGS BY STEAM OR HOT WATER CIRCULATION. POSITIVELY NON EXPLOSIVE. ECONOMICAL MAGAZINE FEED.
SEND FOR NEW ILLUSTRATED DESCRIPTIVE CATALOGUE.
PIERCE, BUTLER & PIERCE MFG. CO.
SYRACUSE, NEW YORK, U.S.A.

H. W. JOHNS'
Asbestos Sectional Pipe Covering

A Non-Conducting Covering for Steam and Hot Water Pipes, etc.
READILY ATTACHED OR REMOVED BY ANY ONE.
Asbestos Boiler Coverings.
We are prepared to take contracts for **applying** *Steam Pipe and Boiler Coverings in any part of the United States.*
H. W. Johns Manufacturing Company,
SOLE MANUFACTURERS OF
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, etc.
87 Maiden Lane, New York. CHICAGO. PHILADELPHIA. LONDON.

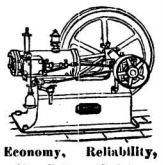
THE FRED'K CRANE CHEMICAL CO.
SHORT HILLS, N. J.-BOX 91A-
ZAPONS, BRUSH & DIP. LACQUERS. VARNISH. SHELLACS. BLACKS, BRILLIANT & DEAD. JAPANS, AIR DRYING. ENAMELS, TRANSPARENT, FOR METAL AND WOOD. PROOF AGAINST ACIDS AND ALKALIES. —WRITE FOR CATALOGUE.—

CROSBY POP SAFETY VALVE
WATER RELIEF VALVE
IMPROVED STEAM GAGE
STEAM ENGINE INDICATOR
Single Bell Chime Whistle, and all instruments used in connection with Steam, Air and Water.
Sole Agents for Clark's Lanen Fire Hose.
NEW YORK. LONDON.
CROSBY STEAM GAGE & VALVE CO. 98 Oliver St. Boston, Mass.

ARMOR PLATE.—AN ELABORATE and interesting historical account of the manufacture of armor plate and of the tests that have been made of the various kinds. Illustrated with 31 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **713, 714,** and **715.** Price 10 cents each. To be had at this office and from all newsdealers.

HOME-MADE INCUBATOR.—PRACTICAL directions for the manufacture of an effective incubator that has been carefully tested and found to perform all that may be reasonably expected; with directions for operating. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **630.** Price 10 cents. To be had at this office and from all newsdealers.

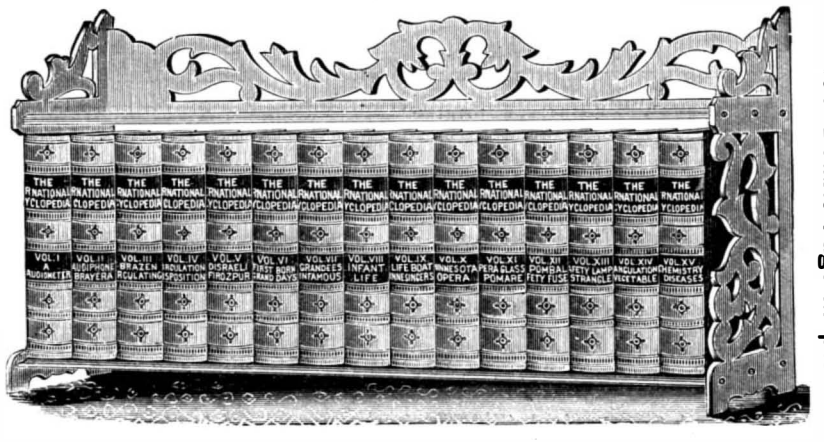
2 to 40 H. P.



Economy, Reliability, Simplicity, Safety.

The MOTOR of 19th CENTURY.
Can be used *Any Place*, to do *Any Work*, and by *Any One*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.* For circulars, etc., address
Charter Gas Engine Co.
P. O. Box 148, Sterling, Ill.

150 Double-Page Illustrations.



100 Double-Page Maps.

THE BEST FOR READY-REFERENCE.

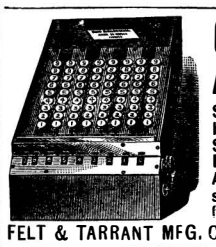
THE INTERNATIONAL CYCLOPEDIA is a complete, comprehensive, ready-reference cyclopedia, published four years ago, at the lowest cost consistent with good paper, good type, good binding, and good editing, and is better to-day because of careful revision.

No other Cyclopedia approaching it in size—15 volumes, with 50,000 titles—is sold at so low a price; and no other so generally contains the latest information and statistics. Yet its cost is moderate, and terms of payment easy—if you wish. Delivered free of expense. Correspondence solicited.

Salesmen wanted. Address, **SUBSCRIPTION DEPARTMENT,**
DODD, MEAD & COMPANY, Publishers, 753 & 755 Broadway, New York.

SYRACUSE MALLEABLE IRON WORKS
W. B. BURNS PROP'R

THREE ELEVATORS
A Day is the output of
OTIS BROTHERS & CO.'S
Passenger and Freight Elevator Works,
General Office, 38 Park Row, New York.
THE OTIS ELEVATOR



COMPTOMETER
ALL ARITMETHICAL PROBLEMS
Solved rapidly and accurately by using the Comptometer. Saves 40 per cent. of time. Entire relief from mental strain Adapted to all commercial and scientific computations. Send for circular.
FELT & TARRANT MFG. CO., 52-56 Illinois St., Chicago.

SEAMLESS BRASS & COPPER TUBES, SHEET BRASS, BRASS WIRE. CHARLES'T BRASS & COPPER CO. FINE TOOLS & TAPS. SEND FOR CATALOGUE. 175-177 LAKE ST. CHICAGO.

ESTABLISHED HALF A CENTURY.
MARVIN'S
FIRE & BURGLAR
SAFES
HAVE MANY PATENTED IMPROVEMENTS NOT FOUND IN OTHER MAKES
THAT WILL WELL REPAY AN
INVESTIGATION
BY THOSE WHO DESIRE TO SECURE
THE BEST SAFE
MARVIN SAFE CO.
NEW YORK, PHILADELPHIA, LONDON, ENGLAND.

Hoskins' Patent Hydro-Carbon
BLOW-PIPE
AND ASSAY FURNACES.
No dust. No ashes. Cheap, effective, economical, portable, and automatic.
Send for Price List.
W. Hoskins, 81 S. Clark St., Room 50, Chicago, Ill.

VELOCITY OF ICE BOATS. A COLLECTION of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of ice boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **214.** Price 10 cents. To be had at this office and from all newsdealers.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's Book of **SAWS.** We are first to introduce NATURAL GAS for heating and tempering **Saws** with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address
EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa.

MAGIC LANTERNS
AND STEREOPTICONS FOR SCHOOLS & PUBLIC ENTERTAINMENTS
LANTERN SLIDES COLORED & UNCOLORED
SEND FOR CATALOGUE
QUEEN & CO.
PHILA. PA.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

OUR MAGIC LANTERNS WITH OIL LAMPS HAVE NO EQUAL
VIEWS OF ALL SUBJECTS
EASTERN PRICES GUARANTEED
SEND FOR CATALOGUE
L. MANASSE
88 MADISON ST. CHICAGO ILL.

PRINTING INKS.
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.

© 1890 SCIENTIFIC AMERICAN, INC.